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A Quantitative Analysis of Information Systems Management in the Educational Industry

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Abstract: 1. Purpose: One of the consequences of the COVID-19 pandemic period was the migration of educational centers from face-to-face learning to e-learning. Most centers adapted their educational services and technological resources so that the students could attend the courses online and the teachers (and the rest of the staff) could telework. So, technology departments have become critical in educational services and need to adapt their processes. The ITIL (Information Technology Infrastructure Library) standard guides companies for this transformation. If educational centers are involved in digital transformation, the question to solve is the following: How far are the processes used in the technology departments of educational centers from the ITIL standard adopted in the information technology industry? The purpose of this research was to investigate whether technology departments have implemented the necessary processes. 2. Methods. The research was conducted by means of an online form sent to educational organizations to gather information about their technological processes. The responses collected from the web forms were statistically analyzed. 3. Results and conclusion. The main finding in this paper was that technology departments in educational centers have yet to adopt the processes required for an intensive online service, demonstrating a weakness in educational institutions.

Keywords: educational centers; IT management; systems and processes; analysis

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1. Introduction

1.1. Technology-Based Services and the Impact of COVID

Growth in the number of technology-based companies in recent years is a fact. This growth has led to the appearance of new services and new business models in the market. These services and business models are based on an intensive use of IT (Information Technology), which means that IT departments are becoming the foundation of many companies. This transformation was accelerated by COVID pandemic conditions [1], increasing the risks associated with IT transformation [2,3]. The new COVID conditions obliged companies to massively adopt teleworking [4,5]. However, the adoption of technology is not homogeneous in all countries. This article addresses the differences between countries in the north of Europe and countries in the south of Europe in terms of digital transformation. It also indicates that the extent to which knowledge-intensive business services predominate can explain the differences.

In the case of educational services, teleworking encompasses distance education and online learning, video streaming-based learning, distributed learning environments and similar solutions adopted by educational institutions and centers [6–8]. These are knowledge intensive jobs and yet there are still big differences in adopting technologies that ease remote services, such as e-learning services. One reason, explained in [9], is that small-sized companies face handicaps in incorporating technology and processes that could help them move forward in digital transformation. Other reasons are explained in [10]. This is a common issue in all of Europe due to the generally reduced size of organizations [11,12], but it is even more relevant in southern European countries [13]. For example, in Spain

and other southern European countries, small-sized companies represent up to 95% of total companies, as published by [14,15]. Some other authors have also addressed the limitations of small organizations in profiting from technological and new operating processes [16]. The authors confirm that crises, such as the COVID-19 pandemic, usually have a direct impact on small companies because of their limited resources. This point is particularly important in southern European countries, due to the high percentage of small companies. although not exclusive to this area of the world.

1.2. Technology-Based Services and the Need for IT Processes

The adoption of technology requires new processes to manage businesses [17]. As pointed out in [18] advances in technology usually force creation of new organizational processes never before used. This idea is also presented in [19] where the authors highlight the importance of processes in Information Systems. The need for properly defined processes to manage Information Technology and Information Systems is addressed in recent literature [20] and specifically in literature related to small organizations [21,22]. In such situations, it is important to rely on a standard to properly manage IT services. ITIL (Information Technology Information Library) is a de-facto standard [23,24] for most companies [25] that have a clear dependency on IT departments to develop their businesses (process description is in Appendix A). Authors also highlight the relationship between the use of ITIL and the quality of IT services.

It is important to point out that, according to [26], up to 64% of companies that implement ITIL improve the global perception of the services of their IT departments. The main advantage of implementing ITIL is the enhancement of the Service Level Agreement (SLA) between an IT department and the rest of the stakeholders (other departments, clients, users), addressed by 70% of the companies interested in this standard. Another important advantage pointed out in [26] is the reduction of IT maintenance costs after implementing ITIL. This result is also reported by authors in [27].

Another study carried out by Axelos [28] also supported this idea. ITIL not only helps organizations to better obtain services from IT departments, but ITIL also helps digital transformation of organizations by demonstrating the processes that should be considered in IT. As explained in the ITIL handbook, the implementation of this standard adds value to the organization, which was recognized in [28]. Another example can be found in [29] which explained the alignment of IT departments and businesses, and the improvements in cost efficiency, productivity and customer satisfaction, among others.

Nevertheless, as explained in [30], even if a great number of experts consider ITIL a key factor in improving IT quality [19], there are a high number of small companies declaring interest in ITIL but having no time or resources for its implementation (in Europe more than 90% of companies are such small companies).

1.3. Educational Centers

The need to improve IT services also applies to the educational industry [31]. Investments are urgently needed to ensure that educational centers have the IT infrastructure necessary to succeed. Most of the incidences and problems experienced by users (teachers, students and other staff) concern limitations in daily operations, security aspects, updating processes and setting up the devices and applications. All these issues increased during COVID lock down, due to the increase in use of video–audio tools and learning management systems to follow on-line and distance courses.

The importance of ITIL processes in educational centers for different purposes was observed in previous references, such as [32,33]. The need to improve IT services in educational services was extended to universities in [34,35], which highlighted the fact that IT services in the educational industry go further than simply attending to the needs of teachers and students and also concern how ITIL can help improve the set of services offered in an educational institution and, specifically, how e-commerce functionalities are deployed in a university following ITIL best practices.

Educational companies are usually small- or medium-sized companies and they experience the same problems as other such companies and industries in managing IT [36,37], as pointed out in Section 1.1. The main problem with these small organizations comes from the lack of resources to dedicate to every specific task needed to offer online and distance educational services. In fact, it is typical that no resources are dedicated to implement ITIL in the IT department [38,39]. The main handicap comes from the long and expensive work that the implementation of ITIL processes requires. Companies that decide to implement ITIL assume a high risk of failure in its implementation. Offering high quality in IT services requires implementing between 25 and 35 processes (depending on the version of ITIL). There are several factors that may affect the implementation of ITIL and that explain the difficulties in implementing it [40], mainly in small organizations [41].

This paper analyzed if training and educational centers were prepared to support highly IT-based services by analyzing how far they were from the complete implementation of ITIL processes, and considered the following: (a) the quick change forced by the pandemic period to offer online and remote services; (b) the importance of IT processes based on extended standards, such as ITIL; (c) most educational centers are small- or medium-sized organizations.

The relationship between the ITIL standard and IT departments mainly affects companies that do not make use of the new SAAS (Software As A Service), PAAS (Platform As A Service) nor IAAS (Infrastructure As A Service) paradigms. Companies based on these new models could not fully apply the ITIL standard as most of the processes proposed are carried out by third party companies. In this sense, the companies could define service level agreements to require compliance with ITIL processes. This paper focused on companies that internally manage IT services.

The next sections address a literature review, the methodology followed and the results found, as well as a discussion section and the obtained conclusions.

1.4. Literature Review

1.4.1. ITIL as de Facto Standard

The gradual transformation of IT departments into service departments is accomplished by standards and practices [42]. Some examples of these standards and practices are Control Objectives for Information and Related Technology (COBIT), ITIL, ISO20.000, Microsoft Operations Framework (MOF), and Business Process Model and Notation (BPMN), among others. These standards are typically combined [43], although ITIL offers the most extended framework [23,24,44]. The management of IT services, in the ITIL framework, is driven by processes which are based on best practices in the market, composed of five sets of processes [45]: Service strategy, Service design, Service transition, Service operation, and Continuous improvement. This offers a clear set of processes to be implemented in every organization [46] but does not indicate how to implement ITIL or the order of processes when implementing it. In every new version of ITIL, the processes are adapted to the needs of technology and market. The re-definitions of processes keep them aligned with the needs of companies. The implementation of ITIL provides a reduction of costs, a better service in terms of availability, an improved governance and satisfaction for users [23,47].

1.4.2. Analysis of ITIL Implementation

The implementation of ITIL was analyzed by different authors from different points of view which can be classified into two main groups:

(1) Authors who study the methodologies, strategies and factors that help in implementation of ITIL
(2) Authors who study the implementation of ITIL in organizations grouped by common characteristics (size, region, industry, and so on)

The first main group of articles describe how to implement ITIL and which elements should be considered during the implementation. The topics analyzed are diverse but they can be classified as follows:

(a) Order of ITIL processes to follow for its implementation [48–52]. These authors study the order of processes that an organization should follow to fulfill ITIL implementation. The approaches are based on different ideas, such as mathematical models, relationships among ITIL processes and studies using Delphi methodology.
(b) Critical success factors that should be taken into account for success in ITIL implementation [53–59]. In this case, the articles are generally oriented to studying different topics that influence the success (or failure) of particular ITIL implementations. The case of [60] is significant, as it classifies and evaluates the impact of different groups of success factors: organizational, human resource, project management, managerial and process related factors.
(c) Methodology to follow to make the implementation a success [40,61–67]. These authors study ITIL implementation and its organization in terms of which steps should be considered, how to schedule it and how to deal with the implementation itself. Or the authors may simply analyze how to ease ITIL implementation through following guidelines [68].

The second approach to analyze ITIL implementation focuses on the characteristics of the organization. The literature can be classified in three main groups:

(a) Implementations of ITIL in organizations from a specific region/industry. There are a few examples in this group. For instance, the authors in [22] analyzed the implementation of ITIL in the Norwegian armed forces, The authors in [69] developed research on ITIL implementation in Brazilian companies, and, in the case of [40], deep research about Australian companies and ITIL was developed. In the case of [70] the implementation of ITIL in the financial sector was studied. Another example which focused on a specific industry was [71] where health care organizations were analyzed in terms of ITIL processes in a cross-national study. It is infrequent to find cross national studies, although some exceptions can be found, for example [25] analyzed the implementation of ITIL in up to four countries (the USA, Germany, the United Kingdom and Australia). More recently, [72] analyzed a specific sector (video conference services) in a specific region (Chile).
(b) Implementation of ITIL by specific sector (private or public). In some cases, the analysis is oriented to understanding the differences between the implementations of ITIL in public and private sectors. Some examples address Australia [73,74] and, more recently, Sweden [75] and New Zealand [76].
(c) Implementation of ITIL by size of the company. It is not difficult to find works on the application of ITIL in large organizations. Some common referenced examples in literature are [22,40,77,78]. The application of ITIL in small companies began interesting for researchers more recently. Several authors have studied the implementation of ITIL in SME [49,50,79–81], although the interest has increased in the last few years [82–85], mainly because it is not really introduced in the core processes and the need to adopt ITIL processes [20] in small companies has escalated. Interest in ITIL traditionally came from big organizations but digital transformation obliged small companies to implement ITIL processes to succeed, as explained in the Section 1.2.

1.4.3. ITIL Implementation in Educational Centers

The implementation of ITIL in educational centers (schools, educational institutes, universities, academies, and so on) has been a recurrent topic [86–93]. These references analyzed the total or partial implementation of ITIL in a variety of educational institutions.

The lack of processes in IT departments is common to many industries and it has generated much research and many publications. Similar can be said for the educational industry [36], as experts recommend implementing ITIL in schools, high schools and universities [94]. Little by little, different ITIL processes are being implemented by educational centers. A good example of the application of ITIL processes in an educational center was discussed in [89]. In this case, it was not a full implementation but a partial one. However, it was useful in understanding the benefits of using a standard, such as ITIL, in call center

and helpdesk support to customers and users. It also clarified maintenance of known processes for new staff, hardware refresh cycles, video tasks and desktop engineering.

When talking about educational centers it is important to take into account that most are small- or medium-sized companies and so difficulties in implementing ITIL apply to schools, academies, training centers, and so on. Small size enforces the adoption of changes in the processes in educational centers. Generally, educational centers show some resistance to change in the way they work [95,96]. It is rather complicated for IT departments in schools to introduce the concept of processes because teachers are not used to working in that way, which was pointed out in [36], with many school staff considering the process to be bureaucratic and an additional administrative task. It is not a question of budget for technology, because the infrastructure is present in small companies. It is a question of lack of process implemented to make use of the technology already present, resulting in no return on investment [97]. The main difficulties, for small educational centers in making use of technology, are lack of technical resources at a reasonable cost, lack of resources specialized in the particular industry of education, and lack of clarity about new products demanded by the market [98]. We can conclude that schools and other small educational centers have technology, but they do not have resources to implement processes to obtain benefits from the technology.

The main disadvantage of ITIL implementation derives from the order in which processes should be implemented. Big and small companies have similar problems because the selection of the processes to implement is usually based on expert opinion, biased algorithms or criteria not applicable to an industry [48].

So, if ITIL is so important among IT departments in big, medium and small organizations, and resistance to change, lack of human resources and other factors represent handicaps in implementing ITIL in small centers, the question is: Which level of implementation of the ITIL processes is appropriate in small educational centers?

This article presents the results of research developed to solve this question. In the next sections we present the objective and hypotheses, the research method and, finally, the conclusions obtained.

2. Materials and Methods

2.1. Characteristics of the Survey

As was explained in the preceding section, it is common to analyze the implementation of ITIL in a specific country and/or a specific industry. The scope of this research was small educational centers in Spain. The objective was to ascertain the level of implementation of ITIL in these centers.

The training centers included in the study were small and medium training centers in Spain dedicated to any type of educational activity (adults, young people, on-line, face to face, private and public centers, and any discipline of teaching). Table 1 provides the characteristics of the polling.

Table 1. Survey parameters.

Item	Value
Location	Spain
Universe for polling	Small educational centers
Type of request	Web form
Requests sent	220
Answers received	100
Minimum (significant)	64
Confidence level	90%
Organization selection	Randomized

Table 1. *Cont.*

Item	Value
Mode	One-step
Type of questions	Multiple choice: 1. Not implemented and not planned 2. Not implemented and medium term scheduled 3. Implemented/On-going implementation

2.2. Participants and Questionnaire

ITIL is the most used standard in terms of IT processes. In particular, the most used version of ITIL is ITIL 2011, although a new version has been recently released-. Anyway, as most companies still use ITIL v2011 as a reference the study utilized this version. For practical reasons, we took into account the 26 most relevant processes.

The participants in the study were randomly selected educational companies. They were small- and medium-sized centers for both young and adult people. The companies offered face-to-face and/or on-line training and were located in Spain. The role of the person who answered the questionnaire was CEO or IT director of the company.

The questionnaire contained 26 questions about the level of implementation of each particular ITIL process and/or ITIL group of processes. Table 2 contains the list of processes in the questionnaire.

Table 2. Questionnaire of ITIL processes.

#Process	Process	#Process	Process
1	Strategic management of the services	14	Service transition schedule
2	Service portfolio management	15	Change management
3	Financial management of services	16	Deploy and version management
4	Service demand management	17	Validation and test management
5	Business relations management	18	Asset and configuration management
6	Service design coordination	19	Change management
7	Catalog management	20	Knowledge management
8	Service availability management	21	Incident management
9	Service level management	22	Problem management
10	Service continuity management	23	Access management
11	Service security management	24	Event management
12	Service provider management	25	Request management
13	Capacity management	26	Continuous improvement

As indicated in Table 1, the possible answers for each question were:

To indicate that the process had not been implemented yet and it was not in the scheduling of the center.
To indicate that the process had not been implemented yet but implementation was planned in the short/medium term or the project for its implementation had started.
To indicate that the process was already implemented or the project was ongoing and the process would be implemented in the short term.

2.3. Validation Method

The interest of this study was to ascertain if ITIL processes were implemented in educational centers. The method used to validate the results was a *t*-student test, the

common test to validate if a mean value is higher than a reference or not. Considering the possible given values for the answers, a *t*-Student test was carried out to analyze if the mean for each process was higher or equal to 2.5. Accepting the null hypothesis meant that the process was implemented: the (statistically significant) mean was close to a value of 3. Otherwise, the alternative hypothesis should be accepted, meaning that the mean for a particular process was lower than 2.5 (not implemented). This meant that the process was not implemented (and would not be implemented) or was still on the way. The test hypothesis was established as follows:

H0. $\mu >= 2.5$.

H1. $\mu < 2.5$.

The significance level for the test was α = 95%. The results and analysis of the tests are shown in the next section.

2.4. Data Collection

The data was collected through a web form and stored. The data are available in the https://zenodo.org/record/4445279#.Y39423XMKP8 (accessed on 30 September 2022).

The processes defined in ITIL for any IT department in any company (including educational companies) are grouped in 5 different sets: Strategy of service, Design of service, Transition of the service, Operation of the service, Continuous improvement. It was decided to require information about every process of each group, but finally up to 26 processes were analyzed, as not all of the questions were answered by all of the companies and the number of answers were not enough for the analysis. The data were received online received and stored in a database for statistical analysis.

The next section describes the results after statistical tests.

3. Results

In this section, the results obtained for every group of ITIL processes are reviewed and the meaning examined.

3.1. Question 1: What Is the Level of Implementation of the Processes of ITIL in Small Educational Centers?

3.1.1. Strategy Processes

The average for every process contained in the set of strategy processes is represented in Table 3. The processes in this group are related to the capacity of the educational center in defining processes strategically and in alignment with the business [65]. This means that processes should be managed considering the demand for services offered by the business (that is, IT department should take into account the real needs of the business instead of defining the products and services by itself), financial aspects of the implementation of the service (for example, estimating the cost of a new learning management system to offer online training) and the current portfolio of services (i.e., the list of services offered by the IT department should be clear and known by the rest of the departments) [69]. As can be seen in Table 3, there was no process with an average higher than 2.5. In fact, all the results were near 1.5. So, the question is: What does this mean? It was clear that the results showed that training companies did not establish the services offered considering the strategical needs of the business.

This situation is typical in companies where services offered from the IT department are not connected with the real needs of the company [62]. That is, business and IT do not walk together but in different ways. Looking at the results it can be deduced that the process that would unify the services offered in IT and the needs of the business was the one with the worst value, meaning there was no specific process for communicating and defining any strategy for IT services. This situation is not unique in training and educational centers but it is often found in small companies [49]. This set of processes can be addressed as 'high level' processes meaning that they are far from operative daily; so, it is understandable that small companies score low. Small educational centers focus their efforts on solving

daily problems and incidents and hardly think about these processes [86]. Looking at Table 3 we can conclude that strategy processes were far from being implemented and small companies did not pay attention to high level processes.

Table 3. Results of t-Student test for Strategy group of processes.

#Process	t-Value	*p*-Value	Mean (at 90%)	Result
1	−10.35	$9.41\ 10^{-18}$	1.47–1.76	Reject H0
2	−7.43	1.8810^{-11}	1.66–197	Reject H0
3	−8.15	5.5610^{-13}	1.63–1.92	Reject H0
4	−8.89	1.4110^{-14}	1.57–1.86	Reject H0
5	$-\infty$	0	1–1	Reject H0

3.1.2. Design Processes

The results obtained for the design processes are given in Table 4. Design processes define the tasks and procedures needed to develop a new IT service or product; for example, a non-assisted e-learning service [65]. The level of implementation was higher than the level of implementation of strategy processes. This was due to the fact that these processes are closer to daily operation and so they are closer to IT tasks. It means that, independently of how the services and projects of the IT department were defined, the processes to design them were more known and had a higher level of implementation.

Table 4. Results of t-Student test for Design group of processes.

#Process	t-Value	*p*-Value	Mean (at 90%)	Result
6	−9.40	1.0710^{-15}	1.54–1.83	Reject H0
7	−6.87	2.8310^{-10}	1.73–2.02	Reject H0
8	−8.3	2.6610^{-13}	1.60–1.90	Reject H0
9	−9.46	7.9910^{-16}	1.52–1.81	Reject H0
10	−10.45	5.6910^{-18}	1.50–1.77	Reject H0
11	−9.10	4.9810^{-15}	1.56–1.85	Reject H0
12	−8.83	1.8810^{-14}	1.59–1.88	Reject H0
13	−9.63	3.4810^{-16}	1.53–1.82	Reject H0

Nevertheless, it cannot be concluded that these processes were generally implemented. Even if the values obtained were higher than for strategy processes, the mean was far from the value 2.5, used as reference. The results obtained for the test: H0: $\mu >= 2.5$, H1: $\mu < 2.5$ show that the null hypothesis was clearly rejected and so we must accept that $\mu < 2.5$ for every process in the design group of processes.

This situation is common in small companies where IT teams are small teams and they focus their efforts on solving daily problems [38,48] instead of developing high level tasks. It can be observed that processes closer to daily tasks and needs seemed to have a higher level of implementation [6]. If we look carefully at the results, the process that achieved the highest value was security management. This was due to the importance of these processes for training companies. Although the value was far from 2.5, we cannot deduce that there were no specific measures (firewalls, encrypted passwords . . .) but there was not a specific process known by all IT staff to apply the measures [2].

3.1.3. Transition Processes

Transition processes are the set of processes that take care of moving services into production, that is, software developments, hardware, new products are moved into

production environment following transition processes [23]. The level of implementation was clearly higher than for strategy processes and a little higher than for design processes. The results can be observed in Table 5.

Table 5. Results of t-Student test for Transition group of processes.

#Process	t-Value	*p*-Value	Mean (at 90%)	Result
14	−8.93	1.1510^{-14}	1.53–1.84	Reject H0
15	−9.63	3.4810^{-16}	1.53–1.82	Reject H0
16	−9.13	4.1910^{-15}	1.53–1.83	Reject H0
17	−7.76	3.8410^{-12}	1.62–1.93	Reject H0
18	−8.84	1.8010^{-14}	1.64–1.85	Reject H0
19	−10.75	1.2310^{-18}	1.47–1.74	Reject H0
20	−11.19	1.3910^{-19}	1.46–1.73	Reject H0

As can be seen the average implementation for every process in this set was slightly lower than for the previous group of processes. The explanation for this phenomenon was that transition processes are high level processes and they imply management of non-technical issues and so, they are further from typical technical tasks and are usually not considered in IT departments (or at least, not considered as they should be).

The null hypotheses tests revealed that the average was far from 2.5, and processes were not generally implemented.

These processes are useful when implementing new functionalities and services from the IT departments, for example moving from non-synchronous learning services to synchronous learning services, or from synchronous learning services to group activities [11,32]. School or training centers cannot gauge the impact of new functionalities, tests and validations on previous services on parts of previous services if the processes in Table 5 are not implemented.

3.1.4. Operation Processes

The group of operation processes shown in Table 6 concern maintaining the services operative [65] so that students, teachers and the rest of the community can make use of the learning services whenever they desire. The processes affected are related to solving incidents and problems [83], access management and new requirements management for the established services offered from IT departments [35].

Table 6. Results of *t*-Student test for Operation group of processes.

#Process	t-Value	*p*-Value	Mean (at 90%)	Result
21	−6.16	7.5210^{-9}	1.77–2.08	Reject H0
22	$-\infty$	0	1–1	Reject H0
23	−8.49	1.0310^{-13}	1.59–1.88	Reject H0
24	−11.81	6.3110^{-21}	1.42–1.69	Reject H0
25	−7.10	9.5010^{-11}	1.67–1.98	Reject H0

This explains why these processes are perceived as critical by IT departments. In general, we can say that IT departments associate quality in the service with the implementation of these services [24,54,62]. This also explains the results obtained: the average of implementation for every process was higher than for the previous group of processes.

However, even obtaining better results than in the rest of processes, the null hypothesis test showed that the value of the level of implementation was still far from the 2.5. The null

hypothesis was once more rejected meaning that these processes seemed to be relevant enough for IT departments, but we could not conclude they have general implementation among educational companies.

3.1.5. Improvement Processes

The processes related to continuous improvement were also far from general implementation [65]. The average obtained (Table 7) was 1.91 which clearly was under 2.5.

Table 7. Results of *t*-Student test for Improvement group of processes.

#Process	t-Value	*p*-Value	Mean (at 90%)	Result
26	−6.17	7.3510^{-09}	1.76–2.07	Reject H0

4. Discussion

The objective of the research was to answer the question as to whether the IT departments of educational centers had implemented the processes needed to offer high quality learning services. To reach this objective we analyzed the level of implementation of ITIL processes in the IT departments. What we learnt from the study was that schools, high schools, academies and other training centers do not pay enough attention to the quality of the services offered to the rest of the departments, to the students, teachers and other stakeholders.

The analysis was developed by means of groups of processes [65] (as defined in ITIL) and the results obtained in the research showed a clear deficiency in the management of services of IT departments. This method of analyzing was quite common in the literature analyzed, for example [17,22,46,64,77,79], among others.

The users (all of the users: students, teachers, parents, and so on) are the consumers of the services offered by IT department [6,33] and the quality of services offered to them should be prioritized. The most important processes are compiled by the ITIL standard and, as it has been shown, there is no evidence that they are sufficiently implemented in the educational industry. The average implementation was far from the value 2.5, meaning that every process was not implemented nor would it be in a short term. The need to adopt ITIL is well identified by authors [24,33,40,64,94]. All these authors agree on the importance of a proper IT service for a high-quality educational service.

Regarding the results, it can be accepted that high level processes are very far from being implemented, i.e., strategy, transition and improvement groups of processes. These groups are characterized by a higher level of management [65], which means they refer to non-technical issues. These processes are typically useful for a proper management of requirements, changes, versions and selection of products and services. Our results were aligned to other authors' results [48] and even aligned to what happens in other industries [15]. The lack of these sets of processes does not mean that services cannot be offered by the IT department, but management of the services offered is harder. Any change required, new functionalities, looking for incidences and many tasks would hardly be developed, which is common in small- and medium-sized organizations [20]

On the other hand, it is typical that IT departments center their efforts on 'operative tasks', represented by the group of operation processes. This situation is particularly extreme in medium and small companies like educational companies [79,82]. Nevertheless, in this case, the results show that training companies are far from completing the implementation of these processes. That is, these processes are neither implemented nor will be in the short or medium term.

As this is something observed in small companies in other industries the best explanation is that the size is a critical factor [9,59,60,82]. That is, as educational centers are small or medium companies, they do not have enough resources in IT to dedicate to ITIL implementation. This finally impacts on the quality if services offered from IT [24,51]. We

can conclude that educational centers do not have the resources needed to compete in the market.

The conclusions obtained are summarized in the following points:

The processes proposed in this standard are relevant and enough for the correct management of services. As pointed out by several authors [30], ITIL is a de-facto standard that is really useful to manage IT services. As more and more educational companies are moving to online services, ITIL provides the list of processes needed.
The management of IT services, mainly e-learning (but there are other relevant services like enrolling, video classes, administrative tasks and similar) will become more and more difficult. The lack of proper processes is harmful and service quality will be affected, aligned to [6].
Examples where ITIL processes were implemented showed better results in terms of efficiency and quality services. This conclusion is also supported by [24,54,62].
A weakness issue was detected in educational centers: tests showed a lack of correct management of IT services. Something similar was published in [6,33,94], but the present study went further and demonstrated how far away educational centers are from proper IT management. As learning is moving to online learning, better IT services are required. This high level of IT services cannot be offered with the existing resources, meaning that the number of resources needs to increase, as does their training. This transformation has succeeded in other industries like financial, insurance or e-commerce but is just starting in educational industry.

Regarding the limitations of this study:

It is important to highlight that it was conducted in Spain, so its validity is limited to Spanish educational centers and world-wide countries with similar educational centers. In southern European countries there exist similarities in the size and handicaps of small companies, as explained in the Introduction section. This similarity is addressed by authors in [11,12,71].
A second limitation comes from the number of responses. Even if the results are statistically significant, deeper research (with more responses) could help to validate the results obtained in this study. As shown in previous sections, the literature review usually offers results by applying ITIL to very specific and limited industries, sectors or companies. In this sense our study was wider and deeper [22,25,47,57,75,76,86,87,90]

This research opens new lines to investigate:

The real needs of small centers in terms of IT processes requires investigation. The needs of a center with teachers and students at home is different from the needs of a small company in the financial, health or any other industry. In fact, this was the most recurrent topic about the implementation of ITIL deduced from a great number of publications [12,38,43,49,50,79,82] as well as from the results indicated by the authors in [1,20,81,84,85]. Our results were aligned with the conclusions of these authors as all agree on the significance of small organizations and their characteristics and the need to specify implementations of ITIL, as mentioned in [11].
Once the needs are known, prioritizing these needs requires future work on successful digital transformation.
As happens with educational software tools, which are specific for the learning industry, analysis if whether IT processes should follow a standard like ITIL or it would be better to define specific processes for educational centers is required.

5. Conclusions

This study analyzed the level of implementation of best practices, represented by ITIL processes, in small educational centers. The results showed a weakness in the IT departments which requires improvement in these centers. There is a clear lack of procedures and processes in IT departments of small educational centers. This is critical in the current pandemic period, as schools, academies, institutes and universities are moving into

distance learning, e-learning and teleworking and the implementation of proper processes in IT departments can help to manage emerging issues in educational centers, such as security, remote helpdesk services and management of multi-platformed apps, among other issues.

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Appendix A

ITIL Process	Description
Process 1. Service strategy management.	This process defines the guides for the design, development and implementation of the service management.
Process 2. Service portfolio management.	It describes how to provide the IT service in terms of the value generated for the internal/external client.
Process 3. Finance management.	This process describes how to manage the financial aspects of a service provided by any IT department.
Process 4. Demand management.	All demands for all existing services are required to be ordered, prioritized, sequenced.
Process 5. Business relation management.	This process sets the relationships between managers and IT service providers as well as reporting to managers.
Process 6. Design management.	It defines all the tasks required to define and develop the IT service
Process 7. Service catalog management.	This process aims to create and maintain a list of services provided by the IT department.
Process 8. Availability management.	The aim of this process is to ensure that the service level agreement, in terms of availability, is reached to satisfy the needs of the client.
Process 9. Service level management.	This process configures the indicators and service level agreements procedures to maintain services under control.
Process 10. Continuity management.	The process establishes the procedures and tasks to maintain the business as operative even in cases of incidences or events.
Process 11. Security management.	The purpose of this process is to guarantee that the of data protection is applied all over the IT department that offers the IT service.
Process 12. Provider management.	This process sets the rules to select, hire and release provider contracts.
Process 13. Capacity management.	The objective of this process is to guarantee that the current and future needs of resources are satisfied.
Process 14. Transition management	The transition management process describes the plan to move services into production environment, mainly resources and risks.
Process 15. Change management.	Every change in the IT service needs to be evaluated, prioritized, planned, tested, documented and delivered.

ITIL Process	Description
Process 16. Deployment and version management.	The aim of this process is to describe the steps required to make a verified service live
Process 17. Validation and test management.	This process describes how to test and verify the quality of a service before going live.
Process 18. Configuration management.	The assets managed by any IT department require a proper definition of management policy. This process is in charge of this.
Process 19. Evaluation management	This is a generic process to verify if the service performance is acceptable or not.
Process 20. Knowledge management.	This process covers the treatment that should be given to the information generated: where, when, who and how to store and retrieve it.
Process 21. Incidence management.	This process is in charge of the treatment of all incidences, describing the steps to consider for every new incidence.
Process 22. Problem management	The objective of this process is to provide a framework to analyze the origin of every incidence; it is not a question of solving it, but finding the cause.
Process 23. Access management.	The purpose of this process is to describe the control, registration and handling of every access to services by the clients.
Process 24. Event management	Event management refers to infrastructure issues that may affect the global service provision.
Process 25. Request management.	During on-going service period, new requirements appear, so this process defines how to treat every new requirement.
Process 26. Improvement management.	The objective of this process is to define how to handle the continuous improvement task required in every IT service.

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