



Department of Information Science and Technology

Information System to Manage the Evaluation of Employees' Performance in a Preschool:

A Prototype in Development

A Dissertation presented in partial fulfilment of the Requirements for the Degree of

Master in Computer Engineering

Specialisation in Information and Knowledge Management Systems

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October, 2017

“An understanding heart is everything in a teacher, and cannot be esteemed highly enough.”

Carl Jung

“It is the supreme art of the teacher to awaken joy in creative expression and knowledge.”

Albert Einstein

“Education is what remains after one has forgotten what one has learned in school.”

Albert Einstein

Acknowledgements

I would like to thank everyone that supported me in achieving this long-awaited milestone of completing my Masters, and particularly:

To ISCTE-IUL for teaching me about team work and to have pride in my work;

To Professor Abílio Oliveira, for guiding me in the right direction and believing that I was able to get to the end of this journey successfully;

To Teresa Tomás, for educating me about the Portuguese Education System with much appreciated patience and dedication;

To Lena, for helping me find what I needed in the Portuguese Legislation and being supportive of the whole process;

To my late grandfather Manuel, who has always been an example of resilience and who taught me to fight for what I want and to never give up regardless of the situation;

To Dalila, for inducing the beginning of this project with a simple informal conversation on my birthday dinner in 2015 (thank you for your involuntary gift!);

To Núcleo de Instrução e Beneficencia for being my first school, giving me great childhood memories, and after 30 years, embracing my ideas and giving me the opportunity to help improving their service;

To my friends and family for understanding my needs through this whole process and supporting me all the way.

Resumo

Na educação, os professores são um dos componentes mais importantes para o sucesso. Mais do que isso, os professores são antes de mais pessoas, e como quaisquer pessoas, têm os seus pontos fortes e pontos fracos. Um processo de avaliação de desempenho pretende capturar as falhas e usar essa informação para melhorar, consistentemente, a qualidade do serviço prestado pelos profissionais. Numa tentativa de alcançar um progresso positivo, trabalhamos com um jardim-de-infância português para informatizar um processo de avaliação de desempenho para todos os seus profissionais. O grande objectivo desta dissertação é assim suportar a implementação deste processo, com a proposta e desenvolvimento de um modelo de Sistema de Informação (SI) que possa auxiliar os órgãos de gestão do jardim-de-infância a compreender o que se passa, e o que precisa de ser ajustado, de modo a fornecer um melhor serviço às crianças. Para atingir este objectivo, foi feita a modelação do sistema e desenvolvido um protótipo do SI, posteriormente testado com os utilizadores finais, utilizando dados reais. Estes testes permitiram o ajuste e melhoramento do SI, especialmente devido ao facto de o universo de utilizadores deste SI não estar acostumado a utilizar computadores. Por esta mesma razão, outro objectivo fulcral para esta dissertação é o desenvolvimento de um sistema com uma interface o mais simples e organizada possível, de modo a que todos os utilizadores finais o possam utilizar sem dificuldade.

Palavras-chave

Sistema de informação, educação, crianças, creche, jardim de infância, avaliação de desempenho.

Abstract

In education, teachers are one of the most important components in achieving success. More than that, teachers are first of all people and, like any person, they have their own strengths and weaknesses. A performance evaluation process is intended to capture their flaws, and use that information to consistently improve the quality of the service provided by these professionals. In an attempt to achieve a positive progress, we worked with a Portuguese preschool to implement a performance evaluation process to all its employees. The end goal of this dissertation is to support the implementation of this process with the proposal and development of an Information System (IS) model that can assist the preschool's management in understanding what is going well and what needs to be adjusted, in order to provide a better service to the children. In order to achieve this goal, the system was modelled and developed into a prototype that was then tested by the end-users using real data. These tests allowed for adjustments and improvements of the IS, especially since the universe of users are not accustomed to working with computers. For this reason, another important goal of the dissertation is to develop a system with the most simple and organized interface possible so that all end-users can easily take advantage of it.

Keywords

Information system, education, children, nursery, kindergarten, preschool, performance evaluation.

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Acronyms and Definitions

CASCO – ISO committee that works on issues relating to conformity assessment

DBS – Database Systems

DBMS – Database Management System

DGAEP – Board of Public Administration and Employment (Direção Geral da Administração e do Emprego Público)

DSS – Decision Support System

E-R Model – Entity-Relationship Model

GeADAP – Integrated Management of the Public Administration's Performance Evaluation (Gestão Integrada da Avaliação de Desempenho da Administração Pública)

IEC – International Electrotechnical Commission

IPSS – Private Social Solidarity Institution (Instituição Particular de Solidariedade Social)

IS – Information System

ISO – International Organization for Standardization

ITU – International Telecommunication Union

KPI – Key Performance Indicator

Kindergarten – A school for children between 3 and 6 years old

LBSE – Education System Basic Act (Lei de Bases do Sistema Educativo)

MA – Microsoft Access

ME – Microsoft Excel

MSS – Microsoft SQL Server

NIB – Núcleo de Instrução e Beneficência de Paço de Arcos

Nursery – A school for children under 3 years old

ODBC – Open Database Connectivity

OECD – Organisation for Economic Co-operation and Development

Project STAR – Project Student/Teacher Achievement Ratio

Preschool – A school for children under 6 years old

SIADAP – Integrated System for the Evaluation of Performance in the Public Administration (Sistema Integrado de Gestão e Avaliação do Desempenho na Administração Pública)

SQL – Structured Query Language

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UML – Unified Modelling Language

UNESCO – United Nations Educational, Scientific and Cultural Organization

VBA – Visual Basic for Applications

WSC – World Standards Cooperation

Introduction

Theme Delimitation

Education is vital in human development and evolution. With no education, there cannot be a good society. Nowadays, little children spend most of their time in preschools, and this is one (more) reason why these institutions, and particularly the employees that work there – teachers and other professionals of education –, are so very important in the learning process and in the development of children. Considering this, preschools should have a clear view of what goes on their workspaces, in order to promote a good relationship between professionals and children, in a favourable context.

The evaluation of employees' performance is one of the most used measures to help schools having a real view of the important relationship between children and the professionals. To achieve this goal, a Portuguese preschool proposed an initiative to implement a performance evaluation system for their professionals. Given the complexity of the task at hand, this project intends to develop a custom-made Information System (IS), based on the process of evaluation of employees' performance already defined by the directors of the preschool, which can provide relevant information promptly, allowing the directors to make informed decisions about the uncovered issues, with the intention to solve or mitigate them. The IS will store, calculate and process all the data regarding the performance evaluation system and present final reports with clustered information, that were requested by the decision makers, saving time, manual work and therefore money to the school.

Motivation

Given the importance of children's education, in the present and for the future, our motivation to develop this project is easy to understand. Not only today's children are literally the future of this world, but they are also an inspiration of joy and love for the "outdated children"¹ that we, as adults, are today. Preschool teachers have a very important and difficult job, taking care of our children every day – and most of the day – showing them how the world works, facilitating their adaptation to society as we know it and, frequently, replacing the parents. These professionals deserve a chance to apply their best knowledge in this vital activity, which also means, they have to adapt and learn new techniques for the changing tribe that are today's children. A performance evaluation system can help (each one of) them to identify their strengths and their weaknesses, in order to improve the quality of their activity.

The institution where this project is focused – Núcleo de Instrução e Beneficência de Paço de Arcos (NIB) – was the first social environment where the author grew up, making this an even more meaningful way to contribute to her evolution. A longstanding institution like this needs to evolve over time according to the new standards of education and technology. This project helps combining these two themes, using technology to improve the evaluation of employees' performance process.

Being the first year that a process like this is implemented in the institution, and also being promoted by their directors, are two big indicators that this will be a successful project, since it is a high priority for all stakeholders. In addition to its academic value, this project will also be useful in a practical way and may possibly be adapted to similar institutions, in the future.

¹ As Dr. Seuss says: "Adults are just outdated children" (http://www.huffingtonpost.com/doug-a-sandler/10-things-dr-seuss-can-teach-us-about-life_b_7430334.html)

Overall Goals

Generally, this work aims to improve the evaluation of employees' performance process in its various stages. Its main goals are the following:

- Understand the main issue, i.e. the existing problem and what can be done to resolve it;
- Survey the evaluation process;
- Gathering of requirements, necessities and problems to be solved;
- IS modelling, using Unified Modelling Language (UML):
 - Use cases diagram, to define the functionalities to be implemented;
 - Class diagram, to define what data will be stored and how it will be linked;
 - Relational diagram, to define the design of the data base that will be implemented.
- Implementation of the functionalities defined in the use cases diagram through an IS Prototype.

Methodological Approach

This project starts with semi-structured interviews – according to what we found in the revision of literature and previous works – with the institution's decision makers and employees, in order to understand how the process of performance evaluation was designed, and also to gather its requirements and issues to be solved. This phase will help us and will lead us to the next step, where the IS will be modelled using UML diagrams that meet the collected requirements. After carefully analysing the list of requirements and problems to be solved, the UML diagrams will help validating them with the stakeholders. The next phase is the development of the IS – in terms of a prototype –, including an analysis of the technologies that can be used for the implementation, the selection of the most adequate in this case, the implementation itself, followed by a testing phase, a possible improvement of the functionalities based on the tests' findings, and finally the approval of the prototype by the institution's directors.

Dissertation Structure

In this dissertation, in Part I, there is a brief theoretical, and conceptual, presentation and discussion of the main topics related to our research theme or object: Education, Early-Childhood Education, Education Quality, Performance Evaluation and Information Systems. In Part II we present the planning of this work, and the different phases it involves. In Part III the problem to be resolved is described, as well as the current situation of the project and the detailed requirements. Part IV follows with the requirements graphic representation and the IS model. In Part V the prototype development is discussed including the reasoning in choices made, user tests and final results. Conclusions are finally presented in Part VI.

Part I – Related Literature

Education

Overview

“In confronting the many challenges that the future holds in store, humankind sees in education an indispensable asset in its attempt to attain the ideals of peace, freedom and social justice.” (Delors, et al., 1996, p. 13). As pointed out by the previous citation from the United Nations Educational, Scientific and Cultural Organization (UNESCO), education is one of the most important areas in personal and social development. Even though education is a society procedure in permanent evolution, 20 years after the publication of this statement, it is still considered very contemporary.

Many studies link the lack of education to some of the world’s most important and urgent problems, including poor health, poverty, exclusion, ignorance, oppression, war (Delors, et al., 1996) and food security (Burchi, 2008). On the other hand, a good education is linked to improve human development (Hoffmann, 2006; Ranis & Stewart, 2000), democracy (Türkkahraman, 2012), economic growth (Johnes, 2006; Loening, 2010), social equality (Gyckfason & Zoega, 2003), productivity, income, family and trade (Ozturk, 2001), issues than can help prevent the problems previously listed.

Education is the fundamental tool that leads people to find other tools they need to improve their lives in contemporary societies. Whether it is the knowledge to work and provide for the family or the basic skills to practice personal hygiene and deal with health issues, both developed and underdeveloped countries are greatly affected by the education system they have in place.

“Society cannot carry on without education and vice versa. Education affects not only the person being educated but also the whole community by starting from his/her family” (Türkkahraman, 2012, p. 38).

A well-educated population has a better chance of coming together for common goals and achieving them, then non-educated ones. It is through education that people stimulate their

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curiosity, learn how to communicate, gain the capabilities of interact in society, learn basic knowledge about the world and ultimately – and most important of all – expand the horizons of their own potential.

To build a better society, we need people with knowledge of what to do and how to do it so they do not make the same mistakes from the past. Besides that, yesterday's knowledge is not enough to solve tomorrow's problems. Like Einstein once said, "No problem can be solved from the same level of consciousness that created it". We think that education is a fundamental tool in achieving the greater goal of improving people's lives.

Article 26 from the 1948's Universal Declaration of Human Rights states that "Everyone has the right to education", demonstrating the universal importance of this issue and validating that education is a basic right and necessity in everyone's lives. In conclusion "education can create a safer, healthier and more prosperous world and enhance the living standards by changing the visions and perspectives of individuals" (Türkkahraman, 2012, p. 40).

Early-Childhood Education

Early-childhood education is an essential part of education itself. It is when structured learning starts in a person's life and can hopefully mark the beginning of the never-ending pleasure of learning. The lack of an early-childhood education can greatly impact families' quality of life, since it is the bridge to basic skills and knowledge, and also an essential basis in order to have a future higher education (e.g. Barnett, 2011; Delors et al., 1996; Loeb & Bassok, 2007).

Attitudes towards the sort of learning that will continue through life are formed (...) at the stage of basic education. (...) This is the time when we all acquire the instruments for the future development of our faculties of reason and imagination, our judgment and sense of responsibility, when we learn to be inquisitive about the world around us (Delors, et al., 1996, pp. 115-116).

In addition to the basic role that early-childhood education can play in children's life it can also affect their individual future, and therefore, society's future. In Chetty, et al. 2011's article, based in Project STAR, there are evidence that the preschool classroom of a child can affect its earnings at age 27. It implies that better class quality, smaller size classes and good quality

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teachers, can increase their earnings when compared to children that attended classes with different settings. If this is the case, we can only imagine the difference between these and other children that don't even have access to education at all.

Other studies suggest that the sooner children start to learn subjects such as math or reading, the probabilities of scholar achievements in the future are significantly higher (e.g. Watts, et al., 2014; Claessens & Engel, 2013; Bassok, et al., 2016).

On the other hand, studies that measure the relationship between preschool social competencies and future wellness, also suggest that the children's non-cognitive experiences at this age can prepare them to a better future (Jones, et al., 2015; García, 2014) which includes improving stress responses (Suhonen, et al., 2016) or having a better health as adults (Campbell, et al., 2014).

We also agree that in addition to all the proven positive consequences of an early education, it can also be regarded as “an expression of affection for children and young people, whom we need to welcome into society, unreservedly offering them the place that is theirs by right therein – a place in the education system” (Delors, et al., 1996, p. 14). After all, children are the adults of the future and deserve to be treated with respect, love and joy.

Quality in Education

The importance of education brings the issue of its quality. As mentioned in the previous chapter, a better quality of classes and teachers can improve the advantages of education for the future of each child (Chetty, et al., 2011). Other authors, like Carvalho et al. (2014), Hanushek & Wößmann (2007, 2010), Hibbard & Cobb (2016) and OECD (2012), have discussed this extensively.

But how is education quality defined and measured? In 2006, Barrett's paper reviews the literature on this topic that presents, in the end, five components that emerged from their research: effectiveness, efficiency, equality, relevance and sustainability.

Effectiveness refers to the extent which the education achieves its goals, may they be internal, measuring the goals of the schools, or external, measuring the goals of individuals and society

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as a whole (Barrett, 2006).

Efficiency is often confused with effectiveness, although they are slightly different concepts. Efficiency measures the goals achieved against the inputs that are given. For example, if a school has more financial resources than another school, it is expected that it achieves more goals than the second one (Barrett, 2006).

Education has an important role in bringing equality to society, especially on a human development level, trying to break the differences between social environments, races or even religious beliefs. This is a component often associated with education as a human right, in a way that it can be available to everyone, apart from where they are or what they are associated to (Barrett, 2006).

Relevance is very much related to the purposes of education, which can vary from country to country depending on their development levels. In a developed country, the main purposes of education are associated to “competencies, responsibility, lifelong learning, sustainability” (Barrett, et al., 2006, p. 14), whereas in a developing country the primary goals of education are “subsistence, security, (...) access, livelihoods” (Barrett, et al., 2006, p. 14). Analysing these concepts, we can understand that basic issues are more relevant (have a higher priority) in difficult environments where there are no other systems that can tackle them.

Sustainability in this context implies that all other components should be addressed not only for the present, but also for the future, meaning that any actions taken to improve education should be evaluated in a long-term manner (Barrett, 2006).

Regarding early-childhood education, all the components described before are, of course, valid, but some more specific components should be discussed. In Connors & Morris 2015's article, this topic is discussed and a four-quadrant schema is presented (cf. Figure 1).

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	Structure Components <i>Related to the resources and organization of resources present in the program and classroom</i>	Process Components <i>Related to interactions, relationships, and social processes between and among teachers and children</i>
Program Level <i>Elements most proximal to the learning environment for teachers</i>	<i>Program Structure</i> The resources and organization of resources that directly support teachers' learning	<i>Program Process</i> The interactions, relationships, and social processes that directly support teachers' learning
Classroom Level <i>Elements most proximal to the learning environment for children</i>	<i>Classroom Structure</i> The resources and organization of resources that directly support children's learning	<i>Classroom Process</i> The interactions, relationships, and social processes that directly support children's learning

Figure 1 – Four Aspects of Early Care and Education Quality (Connor & Morris, 2015, p. 268)

Clearly, teachers are an important element in quality for early-childhood education, so improving their motivation and quality should be a priority (Delors, et al., 1996).

Certification of Quality

The most recognized way for an institution to prove the quality of its service to the consumer is by getting a quality certification.

A certification implies the recognition of something done correctly. But who defines what is correct? For that, there are authorities that define what is called by standards. As the World Standards Cooperation (WSC) states: “An International Standard is a document, established by consensus. It describes how to achieve an optimal outcome time after time by using an agreed and consistent approach” (WSC, 2017).

The WSC was created in 2001 joining the International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO) and the International

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Telecommunication Union (ITU), all non-profit organizations, with the goal of strengthening and advancing the international standards systems based of voluntary consensus and also, promoting the adoption and implementation of these standards worldwide. WSC considers that international standards help preserving its' organizations common interests and enable the development of a framework that can be used to disseminate stable and recognized best practices (WSC, 2017).

For the purpose of this work, ISO is the organization with most interest, since it developed the ISO 9000 family that describes a Quality Management System, including its seven standard principles. These principles aim to guide all kind of organizations that want to ensure the quality of their products and services, and become more efficient and customer-focused. They are the following:

1. Customer focus: The primary focus of quality management is to meet customer requirements and to strive to exceed customer expectations;
2. Leadership: Leaders at all levels establish unity of purpose and direction and create conditions in which people are engaged in achieving the organization's quality objectives;
3. Engagement of people: Competent, empowered and engaged people at all levels throughout the organization are essential to enhance its capability to create and deliver value;
4. Process approach: Consistent and predictable results are achieved more effectively and efficiently when activities are understood and managed as interrelated processes that function as a coherent system;
5. Improvement: Successful organizations have an ongoing focus on improvement;
6. Evidence-based decision making: Decisions based on the analysis and evaluation of data and information are more likely to produce desired results;
7. Relationship management: For sustained success, an organization manages its relationships with interested parties, such as suppliers (ISO, 2015d).

The ISO 9000 family includes ISO 9001, which is a document that describes in detail the requirements to be compliant with the standard and it is also the only in the family that can be

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certified to. Today, there are more than 1 million organizations with an ISO 9001 certification all over the world (ISO, 2017). For organizations to continue having interest in these certifications, ISO 9001 must be regularly reviewed and revised, making it continuously relevant to nowadays issues in the matter. The globalization of markets is changing the way organizations operate and at the same time customers have more and more expectations regarding their products and services. This takes a toll on quality standards, which is becoming more difficult for organizations to achieve. That is why following the requirements of ISO 9001 is so important nowadays, they serve as a baseline for organizations to achieve one of their main goals, i.e., customer satisfaction.

The newest version, published in September 2015, is the ISO 9001:2015, and it brings some improvements to the ISO 9001:2008, the previous version. These are the following:

- The new version has now the same high-level structure as other ISO management system standards, so it is easier for organizations that follow more than one standard;
- A rich-based thinking has now a bigger emphasis on the standard;
- Leadership engagement also gains importance;
- It has a structured way of addressing organizational risks and opportunities;
- It increased the effectiveness in dealing with supply chain management;
- It is better adapted to organizations which have services and knowledge as their main product (ISO, 2015b).

The ISO 9001:2015 is structured in different clauses, that focus on the requirements related to different aspects of a quality management system:

- Clause 0-3 – Introduction and scope of the standard;
- Clause 4 – Context of the organization;
- Clause 5 – Leadership;
- Clause 6 – Planning;
- Clause 7 – Support;
- Clause 8 – Operation;
- Clause 9 – Performance evaluation;

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- Clause 10 – Improvement (ISO, 2015a).

When an organization decides to implement the standard, the first steps it should achieve, according to the “ISO 9001:2015 How to use it” manual, are the following:

1. Define the organization’s objectives regarding the implementation of the standard;
2. Have senior management on board with the decision, since the process will need the support of everyone from top to bottom, regarding the process itself and the objectives defined in step 1;
3. Identify the key processes in meeting the objectives as well as the customers’ requirements and expectations and how the processes achieve the customers’ needs.

After this, the organization should evaluate whether it wants a certification or not, since it is not a requirement for implementing the standard. In case they decide to go forward with the certification, the next step is to find an independent certification body to do it, since ISO does not perform certifications, it only defines the standard. The role of the certification body is to audit the organization’s practices against the requirements defined in the standard, and if they meet the requirements, the certification body is the one that issues the certification.

For choosing a certification body, ISO recommends that the organization evaluates several certification bodies, check if they use CASCO (which is a set of standards related to the certification process) and if they are accredited by an independent accreditation body, which is a recognition that they operate according to international standards (ISO, 2015a).

While ISO 9001:2015 is the standard for quality management systems in general, an international cross-sectoral expert group working in ISO/PC 288 WG 1 is developing a specific management system standard for educational organizations, the ISO 21001: Educational organizations – Managements systems for educational organizations – Requirements with guidance for use. It is partially aligned with ISO 9001:2015 and it provides a management tool for all kinds of educational organizations. In March 2017, the standard reached Draft International Stage (DIS), which means that any interested party can submit feedback on the document, and it will be considered before it reaches the published state in 2018 (Naden, 2017).

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This new standard's goal is to specify requirements for an educational organization, including system improvement processes, in order to improve personnel, students and other customers' satisfaction as well as certifying their quality towards all the stakeholders. ISO 21001 is critical since Education is so different from other sectors. In this case, the outcome doesn't depend merely in the educational process but also in the effort and capability of the student/customer. Therefore, the ISO 21001 definition, is based on the interaction between the student/customer and the educational organization. For this reason, ISO claims that ISO 21001 can provide the following benefits to the organizations that implement it:

- “Better alignment of educational mission, vision, objectives and action plans;
- Inclusive and equitable quality education for all;
- Promotion of self-learning and lifelong learning opportunities;
- More personalized learning and effective response to special educational needs;
- Consistent processes and evaluation tools to demonstrate and increase effectiveness and efficiency;
- Increased credibility of the educational organization;
- Recognized means to enable organizations to demonstrate commitment to education management practices in the most effective manner;
- A model for improvement;
- Harmonization of national standards within an international framework;
- Widened participation of interested parties;
- Stimulation of excellence and innovation” (ISO, 2015c, p. 4).

While the ISO 21001 is not final, the Education industry can focus on the ISO 9000. In this work, we address an important part of the quality management process which links to two of the seven standard principals described in the beginning of this chapter: Improvement and Evidence-based decision making. This is the performance evaluation.

Performance Evaluation

Overview

Delors et al. (1996) suggest a number of measures to achieve the quality and motivation of teachers. One of them is the following:

Supervision – Inspections should be an opportunity not only to check on teachers' performance but to maintain a dialogue with teachers concerning developments in knowledge, methods and sources of information. Thought should be given to ways of identifying and rewarding good teaching. It is essential to carry out practical, consistent and regular measurements of what pupils have learned. Emphasis needs to be placed on learning outcomes and teachers' roles in achieving those outcomes (Delors, et al., 1996, p. 148).

So, not only a performance evaluation must be implemented for teachers, but also a continuous “dialogue” between directors and teachers, so that they understand what they are expected to achieve.

Other authors studied the impact of performance evaluation in the quality of education (e.g. Atkinson et al., 2009; Hallinger et al., 2013; Taylor & Tyler, 2012; Wise et al., 1984).

The results of these studies evidenced that teachers subjected to evaluation are more likely to improve their performance, especially when they are provided with detailed information on what they are doing as expected, and what they are not. This measure, when properly implemented, gives additional information to teachers on how they can improve their activity, making the change in their actions toward a better education, easier to achieve.

The implementation of teachers' performance evaluation in Portugal has been widely discussed, since it is a relatively new measure for the country. Teachers are apprehensive about it and they are not sure about the positive outcomes of their performance evaluation (Casanova, 2011).

Nevertheless, this measure is absolutely imperative in connecting teachers to three fundamentals: their sense of public responsibility, concerning the social mission which is assigned to them; the specific nature of teaching and the pedagogical matrix of teachers'

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performance; and finally, the ethical appreciation of their own actions (Baptista, 2011).

Competency Models

There are many different types of models used to implement a Performance Management System (PMS), for this work we are going to discuss competency models.

“Competency Models are effective measurement tools that help employees agree on a common language and comprehend what is understood by superior performance” (Chouhan & Srivastava, 2014, p. 14). Chouhan & Srivastava (2014) also say that a competency model can help organizations to translate their strategies into people’s behaviours, leading to individual and organizational performance improvements.

Taking this statement into account, using a competency model to evaluate workers’ performance seems right to the point, since in a typical competency model, the evaluated competencies are shown to the evaluated before they start working. This way, not only the organizations are evaluating skills that can help them grow, but also workers have knowledge of the goals they are expected to achieve.

One of the first definitions of competency was stated in 1974, by McClelland, defining it as a necessary attribute to perform a certain task that should have 4 characteristics: Knowledge, which represents the foundation for the development of a competency; Skill, which is the capacity to actually perform a task effectively; Aptitude, which is the capacity to perform a task based on some kind of knowledge; Others, which include any other necessary aspects to perform a task (Rico, 2016).

Since then, many other authors developed this subject-matter, including Roe in 1999 (Rico, 2016) and Bartram in 2005 (Cardoso, 2015).

In Portugal, there is a defined model for Public Administration performance management and evaluation which is also based on competencies. The performance evaluation model and process used in this work is an adaptation of this model made by the school in question, since it does not directly apply to non-public institutions. The name of the model for Public Administration performance management and evaluation is SIADAP (Sistema Integrado de

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Gestão e Avaliação do Desempenho na Administração Pública), which can be translated to Public Administration's Performance Management and Evaluation Integrated System. It was first enacted in December 2007 by the Portuguese Public Assembly, aiming at the improvement of the Public Administration management through the definition of a competency model that should be implemented by all public administration institutions.

SIADAP's defines competency as "the evaluation parameter which translates the necessary set of knowledges, abilities to act and behaviours for an effective and efficient performance of the workers' functions" (SIADAP Act no. 66-B/2007, December 28th, Article 4).

SIADAP is divided into 3 subsystems that apply to the performance evaluation of the following: services in SIADAP 1; executives in SIADAP 2; and workers in SIADAP 3. All of these are complementary since their goals are defined based on the goals of the previous subsystem, in order to achieve the primary goals (SIADAP Act no. 66-B/2007, December 28th, Article 9). For the purpose of this work, SIADAP 3 is the most important one, so below we'll analyse its main aspects.

SIADAP 3 has an annual periodicity, in which the performance evaluation refers to the previous year (SIADAP Act no. 66-B/2007, December 28th, Article 41). The evaluation focuses on the results regarding the individual goals and the competencies that the worker should possess to perform its role (SIADAP Act no. 66-B/2007, December 28th, Article 45). The evaluated results are directly linked to the individual goals that are defined and communicated to the worker in the beginning of the year. These can accommodate the following subjects: the effectiveness regarding customers' satisfaction, the quality of the work oriented to innovation and service improvement, the achieved efficiency in simplifying procedures and cost reduction, and finally the development of the individual competencies whether technical or behavioural. Each worker must have at least three goals defined in every evaluation period which must be aligned with the previous described subjects (SIADAP Act no. 66-B/2007, December 28th, Article 46). These results are measured in 3 levels: goal surpassed, with 5 points; goal achieved, with 3 points and goal not reached with 1 point. The final evaluation for the results is obtained by the arithmetic mean of all goals' scores (SIADAP Act no. 66-B/2007, December 28th, Article 47). As for the evaluation of the competencies,

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each worker must have at least five goals defined in every evaluation period. These are defined and listed in specific profiles that are associated to the correspondent job role of all workers (SIADAP Act no. 66-B/2007, December 28th, Article 68). Competencies are measured in 3 levels: competence achieved at a high level, with 5 points; competence achieved, with 3 points and competency not achieved, with 1 point. Similarly to the results, the final evaluation of the competencies is obtained by the arithmetic mean of all competencies' scores (SIADAP Act no. 66-B/2007, December 28th, Article 48 and 49). The final performance evaluation is obtained by combining both the results' and competencies' scores, where the results must weigh at least 60% and the competencies no more than 40%. This evaluation is classified in the following terms: relevant performance for 4 to 5 points; adequate performance for 2 to 3.999 points and poor performance for 1 to 1.999 points (SIADAP Act no. 66-B/2007, December 28th, Article 50).

The outcome of SIADAP 3 can help with the identification of the following:

- Workers' personal and professional abilities that should be developed;
- Training needs;
- Professional behaviours and competencies that need to be improved;
- Possible improvements in the workers' role and associated processes;
- Workers in the position to be compensated for their achievements through performance awards or changes in their remuneration (SIADAP Act no. 66-B/2007, December 28th, Article 52 and 53).

These topics should be considered when revising the workers' objectives and competencies for the following year (SIADAP Act no. 66-B/2007, December 28th, Article 54).

There are 5 stakeholders in the evaluation process (SIADAP Act no. 66-B/2007, December 28th, Article 55). The first one is the evaluator, which is usually the immediate hierarchical superior of the worker or, when it is not available, the following hierarchical superior. Its main functions include the definition of the workers' goals in alignment with the institutions' own goals, review them with the workers and make adjustments when necessary and evaluate their immediate hierarchical inferiors (SIADAP Act no. 66-B/2007, December 28th, Article 56).

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The second one is the evaluated worker that has as main function to make its own self-assessment. The evaluated also has rights, namely, the right to be evaluated, to know the whole evaluation process and to complain about something that it does not agree with (SIADAP Act no. 66-B/2007, December 28th, Article 57). The next stakeholder is the evaluation coordinating council which is composed by superior executives and presided by the top manager. Its main functions are to establish global orientations regarding the objectives, competencies and their measurement indicators (SIADAP Act no. 66-B/2007, December 28th, Article 58). Working next to the evaluation coordinating council, there is the joint commission which has a consulting purpose. It is composed by four people, two administration representatives and two workers' representatives (SIADAP Act no. 66-B/2007, December 28th, Article 59). Lastly, the top service manager has as main functions to ensure that the evaluation model is adapted to the specific reality of the institution, establish the weight of objectives and competencies in the global evaluation, approve all annual evaluations and ensure the preparation of annual report regarding the evaluations (SIADAP Act no. 66-B/2007, December 28th, Article 60).

The evaluation process of SIADAP 3 is divided in the following nine phases (SIADAP Act no. 66-B/2007, December 28th, Article 61):

1. Planning of the evaluation process, and definition of competencies, objectives and results to be achieved; This phase should be carried by the top service manager in the last trimester of each civil year (SIADAP Act no. 66-B/2007, December 28th, Article 62);
2. Self-assessment and evaluation; The self-assessment should be requested by the evaluator to the evaluated, and, after it is completed, the evaluator performs the evaluation; This phase should take place in the first fortnight of January (SIADAP Act no. 66-B/2007, December 28th, Article 63);
3. Conciliation of all evaluation proposals; It takes place in the second fortnight of January by the evaluation coordinating council (SIADAP Act no. 66-B/2007, December 28th, Article 64);
4. Meeting between evaluators and evaluated to discuss the evaluation results as well as defining next objectives, indicators and competencies, during February (SIADAP Act

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- no. 66-B/2007, December 28th, Article 65, 66, 67 and 68);
5. Validation of evaluations and recognition of excellent performances by the evaluation coordinating council (SIADAP Act no. 66-B/2007, December 28th, Article 69);
 6. Joint commission's appraisal of the evaluation process, when requested by an evaluated worker within a period of 10 working days after phase 4 (SIADAP Act no. 66-B/2007, December 28th, Article 70);
 7. Homologation by the top service manager until the end of March (SIADAP Act no. 66-B/2007, December 28th, Article 71);
 8. Complaints by the evaluated workers within a period of 5 working days after phase 7; When applicable, the top service manager has 15 working days to decide on the complaints (SIADAP Act no. 66-B/2007, December 28th, Article 72);
 9. Objectives monitoring and review between evaluators and evaluated (SIADAP Act no. 66-B/2007, December 28th, Article 74).

For a more detailed understanding of SIADAP, please consult the complete SIADAP Act no. 66-B 2007, December 28th by the Assembly of the Republic².

SIADAP has a technological solution developed by DGAEP (Direção Geral da Administração e do Emprego Público), which can be translated to Board of Public Administration and Employment, and it is called GeADAP (Gestão Integrada da Avaliação de Desempenho da Administração Pública), which can be translated to Integrated Management of the Public Administration's Performance Evaluation. As the name implies, this solution can only be accessed by public institutions, since they are the target of SIADAP.

² Portuguese version accessible in October 2017 at:
http://www.pgdlisboa.pt/leis/lei_mostra_articulado.php?nid=1898&tabela=leis

Education System in Portugal

Overview

In Portugal, educational institutions can have one of three statuses: public, private and social, better known in Portugal as IPSS (Instituições Particulares de Solidariedade Social) which can be translated to Private Institutions of Social Solidarity.

Public institutions are defined in the Portuguese law (Public Institutes Act no. 3/2004, January 15th), by being legal entities with public right that own their organs and individual capital, having an indirect administration by the state. They provide services with the quality demanded by law, including requirements associated with economic efficiency and management by quantified objectives. In 2012, 88% of educational institutions in Portugal were public (2012, OECD, PISA).

Private institutions are owned and managed exclusively by private entities and have as their primary goal, gaining profit. IPSS institutions are non-profit legal entities, also formed by private initiative, but with the purpose of expressing a moral duty of justice and solidarity by giving an actual contribute to the citizens' social rights (Decree no. 172-A/2014, November 14th). Due to its purpose of public benefit, these institutions are often helped by the state.

Additionally, educational institutions are directly linked to the Education system, usually different types of institutions are directly linked to different education degrees. On a big scale, there are preschool, school and extra-school education. (DGEC, 2007)

Preschool education was initially created in 1911 in the first republic with the purpose of preparing children to enter school. It was not very successful, since children kept being educated by their families at home, so it was extinguished in 1926. At this point, the women's main role in the typical Portuguese family was to be a mother, where one of its tasks was to educate their young aged children at home. In the end of 1960's women started to work outside of their homes, building a career just like men. It is then when preschools are born, with the purpose of taking care of young children during the work hours of their families. In 1973, preschool education becomes part of the education system with the declaration of Act no. 5/73, July 25th, where its goals are first defined. Following this act, the Ministry of Education created

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the first official preschool in 1978. In 1997, the declaration of the Preschool Education Act no. 5/97, February 10th defines preschool as the first stage of basic education in the education process through life, although not mandatory. It is then created an integrated national preschool education network, including public and private institutions with and without profit motives. These institutions are intended for children of ages 3 to 6, and should have a complementary part in their education alongside and cooperating with the family. The goals of these institutions are the following:

- Promote personal and social development of the child, educating for a democratic citizenship;
- Encourage inclusion of children in various social groups;
- Contribute to the equality of opportunity in school access and success in learning;
- Stimulate the global development of each child, considering their individual characteristics;
- Develop communication and expression through multiple languages to help them relate to and understand the world;
- Stimulate curiosity and critical thinking;
- Provide well-being and safety, namely in individual and collective health;
- Screen for maladjustments, shortcomings and precocity, promoting a better orientation for the children;
- Encourage family's involvement in the educational process and establish cooperation relationships with the community (DGEC, 2007).

School education contains basic, secondary and higher education, where the first two are mandatory in Portugal.

Basic education was initially created in 1911, along with preschool education, in an attempt to reduce the illiteracy problem in Portugal. It started by having 3 degrees: elementary, complementary and superior, where the first three years, correspondent to the elementary degree, were mandatory. At that time, and until 1972, basic education was held in a system that separated both sexes. After several changes throughout the years, mostly related to the

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country's political landscape and the lack of human and material resources, basic education was finally restructured to what it is today. Since 1986, it has a duration of 9 years and it is divided into 3 cycles:

- The first cycle lasts 4 years, usually with one teacher and it provides global teaching. This cycle is intended for children from 6 to 9 years old;
- The second cycle lasts 2 years and provides teaching for multidisciplinary subjects, each one taught by one or more teacher. This cycle is intended for children from 10 to 11 years old;
- The third and final cycle lasts 3 years and it is divided by subjects or groups of subjects, each one handled by one teacher. This cycle is intended for children from 12 to 14 years old (DGEC, 2007).

These are sequential cycles. For a person to start the third cycle, it must complete the second one successfully, and to start the second cycle it must complete the first one successfully.

Age	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Grade	Pre-primary education			1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th
Level/cycle	Pre-primary education			1 st cycle			2 nd cycle		3 rd cycle			Secondary education			
	Basic education														

Figure 2 – The Portuguese school system (OECD, 2012, p. 14)

Basic education can be taught in different institutions depending on the cycle. There are first, second and third cycle specialised institutions, but there are also institutions that provide classes for the first two or even all cycles of basic education. The goals of basic education institutions are the following:

- Ensure a common teaching to all children, promoting their individual fulfilment in harmony by guaranteeing that they can discover and develop their interests, skills, ability to think, memory, critical thinking, creativity, moral sense and aesthetic sensitivity;
- Ensure the balance between practical and theoretical knowledge;
- Develop physical and motor skills, value manual activities and promote artistic

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education in order to raise awareness for different forms of static expression;

- Teach one foreign language and start a second one;
- Provide basic knowledge that allow children to pursue higher levels of education, as well as instruments and methods for individual and group work;
- Build an open conscious related to a humanistic, universal, solidarity-based and international cooperation;
- Develop knowledge and appreciation regarding the Portuguese identity, language, history and culture;
- Provide children experiences that favour their civic maturity, building positive cooperation attitudes and habits among their families and the surrounding world;
- Provide the development of autonomous attitudes, teaching children how to be responsible citizens that are involved in the community;
- Ensure the existence of the appropriate conditions to the development and full use of the children capacities, particularly to the ones with specific educational needs, namely physical or mental disabilities;
- Develop children's taste for a constant update of their knowledge;
- Participate in the educational orientation process, in collaboration with the families;
- Teach civic and moral education concepts, in a conscious way;
- Provide conditions that promote educational and school success to all children (DGEC, 2007).

Secondary education dates back to the 13th century, when teaching was held in monasteries. It was not until the 15th century, that were created minor schools, and therefore secondary education was distinguished from higher education. In the 18th century, with the extinction of religious orders in Portugal, there were constituted multiple new schools, apart from the monasteries. Official secondary education was created in the end of the 19th century and schools are installed in every district. In 1986, the publication of the Education System Basic Act no. 46/86, October 14th (LBSE – Lei de Bases do Sistema Educativo) defines a sequential model of three years that can be implemented in two different forms: courses designed to support continued studies and courses designed to proceed with a working life. Both forms must include

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technical, technological and vocational training as well as a Portuguese language and culture component. LBSE was regulated by the Decree no. 286/89, August 29th, which came to effect in all schools in the country by 1994 (DGEC, 2007). The latest changes to LBSE were introduced by the Act no. 85/2009, August 27th, mainly to change the mandatory degree of schooling from basic to secondary education.

Secondary education is usually taught in secondary schools, but there are also institutions that additionally provide classes for the last cycles of basic education. The goals of secondary education institutions are the following:

- Ensure the development of reasoning, analysis and scientific curiosity, as well as teaching the fundamental elements of a humanistic, artistic, scientific and technical culture in a way that it can support the potential continuity to higher education and integration in the working life;
- Provide the necessary knowledge so that students understand aesthetic and cultural manifestations, enabling the improvement of their artistic expression;
- Encourage study and its application in critical reflection, observation and experimentation;
- Educate through the reality of national and regional life, teaching the appreciation of general society's values and Portuguese culture in particular, so that students are interested in finding resolutions to the country's and the world's problems;
- Provide connections and experiences related to employment, strengthening the proximity between the institution, active life and the community;
- Favour a professional education and orientation, preparing students technical and technologically for their entrance in the employed community;
- Create working habits, individual and in groups, that favour the development of methodical reflection, open minded and sensitive attitudes, helping students adapt to changes (DGEC, 2007).

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Higher education is founded in Portugal by king D. Dinis in 1290, although two great religious schools already existed since the 12th century. Until the 15th century, universities were supported by the main socio-economic groups of that time, which were the church and royal or noble patronage, and their studies circled through theology and philosophy. After that, the interest about experimentation grew substantially and new fields of study are born, like math, astronomy, physics and medicine. In the 18th century the state university arises, where its operation gains a public service property. During D. Maria's reign, in 1837, polytechnic and surgical schools are born in Lisbon and Oporto. It is only in the 1970's that a striking growth is witnessed in Portugal's higher education, due to the creation of new institutions outside the usual centres (DGEC, 2007). Today there are 143 institutions devoted to higher education in Portugal (DGES, 2017).

The main types of institutions where higher education is ministered are universities and polytechnic institutions. According to the LBSE, apart from their common goals, these institutions also have different purposes. Universities should ensure the development of capacities of conception, innovation and critical analysis, whereas polytechnic institutions should administer theoretical and practical scientific knowledge as well as their applications in professional activities. Regarding the common goals of higher education institutions, they are the following:

- Encourage the cultural creation and scientific spirit as well as reflexive thinking;
- Major graduates in different knowledge areas, ready to enter the working environment and to take part in society's development;
- Encourage research and scientific investigation aiming at the development of science and technology, arts and humanities, creation and dissemination of culture in order to develop an understanding of humankind and its surrounding environment;
- Promote the dissemination of cultural, scientific and technical knowledge, that are humankind's heritage, and share it through teaching, publications and other forms of communication;
- Stimulate the constant desire for professional and cultural improvement, allowing for a continuous development of each student's knowledge throughout their life's;

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- Encourage the awareness of the world's problems, particularly, national and regional ones, in an attempt to establish a reciprocal relation with the community;
- Promote and value Portuguese culture and language;
- Promote critical thinking and freedom of speech and research (DGEC, 2007).

Extra-school education is based on a lifelong learning perspective and its goal is to complement school education or compensate the lack of it (DGEC, 2007). For the purpose of this work, extra-school education is not going to be further discussed.

Institution in Study

This work is focused on an institution called Núcleo de Instrução e Beneficência de Paço de Arcos (NIB), which was founded in July 11th, 1909 as a non-profit association linked to education in Paço de Arcos, a Lisbon district's village – promoted to town in 1926 – of Portugal. Its main goal at the time was to promote school attendance and hand out books, clothes and other materials to students in need. In 1942, it opened a school of basic education with a capacity for 40 students, at the time all boys, that later became a school for both sexes. In 1954, NIB's management decided to open a preschool, in an attempt to help future students to get better results in basic education.

Today, NIB is a Private Social Solidarity Institution (IPSS) as per the Decree no. 119/83, February 25th functioning by the Private and Cooperative Education statute. It manages two school centres: a nursery and a preschool, both located in Paço de Arcos. “Creche do Bugio” is one of the used facilities, which was provided by the Oeiras' City Hall, and where most of the nursery is running. The other one is “Casa da Criança Rainha Santa Isabel”, owned by the institution, where the preschool and part of the nursery are located.

The nursery has the capacity for 64 children of ages between four months and two years old. The facilities in “Creche do Bugio” can accommodate 36 of these children and it is divided into three rooms: the nursery, with 9 children of ages between four and twelve months; the one-year room, with 12 children with one year; and the two-years room, with 15 children with two years old. It is also equipped with an indoor and an outdoor playground, a bathroom, a child's bathroom, a bathroom for people with disabilities, a cafeteria, a multi-purpose room, a

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principal's office, a kitchen, a pantry and a laundry room. In "Casa da Criança Rainha Santa Isabel" there are two rooms designated to the nursery, one with the capacity for 10 children, and the other one with the capacity for 18. The human resources working under the nursery consists of four educators, four assistant educators, one general services assistant and one cook.

The preschool has the capacity for 150 children of ages between three and six years old. It is divided into seven rooms that can accommodate 18, 21 or 22 children. In addition to these, there are also three bathrooms, five children bathrooms equipped with a total of 16 toilets and 16 sinks, an indoor and an outdoor playground, a cafeteria, a gym, a meeting room, the pedagogical director's office, a registry, a laundry, a kitchen and a dressing room for general services assistants and cooks. The human resources working under the preschool consists of eight educators, including the pedagogical director, ten assistant educators, four administrative, one general services assistant, one cook, two kitchen helpers and a doorman. There are also other resources that work in the preschool, each one teaching a different subject: English, computers, ballet, karate, music and physical education. The last two also work in the nursery.

NIB's mission is to promote a nursery and preschool education of excellence for all social segments, and for that NIB follows a vision of believing that its work is essential for all children at nursery and preschool levels, so they can achieve quality results regardless of their financial means. For this, there is a culture of excellence practiced by all employees, as well as the adoption of NIB's values by all employees, parents and children. These values are the following:

- Dedication: a dedicated team, wary of the global development of the children;
- Respect for people's individuality: people have the right to be different, unique and special;
- Solidarity: promoting the development of harmonious human relations;
- Justice: practicing a culture of justice and peace;
- Sharing: in a way that everyone can benefit from each other's relations;
- Community: nurturing all relations with the community, all related entities and the families that trust in this work (NIB, 2015, 2017).

Information Systems

Overview

“Information is what our world runs on: the blood and the fuel, the vital principle. It pervades the science from top to bottom, transforming every branch of knowledge” (Gleick, 2011, p. 8).

Information has been around since ever. In “The Information: A History, a Theory, a Flood”, Gleick describes the “talking drums” as a way of transmitting information in ancient Africa. Messages of different natures passed through the sound of drums in different rhythm combinations to neighbour villages. Meanwhile, in Europe, the written word was evolving.

In 1604 Robert Cawdrey attempted to organize the meaning of words in an instructional text called “A Table Alphabeticall conteyning and teaching the true writing, and vnderstanding of hard usuall English words, borrowed from the Hebrew, Greeke, Latine, or French, &c. With the interpretation thereof by plaine English words, gathered for the benefit & helpe of ladies, gentlewomen, or any other vnskilfull persons. Whereby they may the more easilie and better vnderstand many hard English wordes, vvchich they shall heare or read in scriptures, sermons, or elsewhere, and also be made able to vse the same aptly themselues”, better known as “A Table Alphabeticall”. It only described about 2500 words, using simple synonyms for most of them, but this work is considered the first dictionary ever written, making it a milestone in the history of information.

This need to organize information increased through times, since the quantity of information became appallingly huge. In 1941 Jorge Luis Borges published a collection of short stories that included “La Biblioteca de Babel”, translated to English in 1962 as “The Library of Babel”. It described a library that holds all existing information in all existing languages in the form of books. In this library, no knowledge can be found, exactly because all information, true and false, is there. Nowadays, with the rise of the internet, e-mail and social media, everyone has access to so much information in so many forms, that it became a challenge to find the right information at the right time. Filtering and searching are the adopted strategies to deal with this problem, and for that to be possible information needs to be organized somehow (Gleick, 2011).

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Google is a great example of what we know today as organized information, that can be filtered and searched. How else could we find what we are looking for in the sea of bits and bytes that are spread through the internet? What is very important for someone, may have no importance at all for another person. A piece of information can have no meaning to someone and yet it can be very helpful to another person.

Mechanisms of search – engines, in cyberspace – find needles in haystacks. By now we've learned that it is not enough for information to *exist*. (...) Once a piece of information is *filed*, it is statistically unlikely ever to be seen again by human eyes. (...) An unindexed Internet site is in the same limbo as a misshelved library book. (...) Searching and filtering are all that stand between this world and the Library of Babel (Gleick, 2011, p. 410)

Google and other engines like it, turned the internet into a monumental IS about *everything*. An IS is often described as a system that collects, organizes, filters and presents information on a specific subject. It is normally custom-made for a specific purpose, which is why virtually all organizations that have any kind of infrastructure have one or more IS implemented.

Organizations increasingly need to store big volumes of information so they can develop their activities. Companies, for instance, constantly need to correctly store and manage information, since holding the right information in the context of their business can represent the difference between success and failure (Alturas, 2013).

One of the most important roles of IS is to support the decisions of the organizations' stakeholders. These specific IS are called Decision Support Systems (DSS) and their role is to facilitate the process of decision making by saving manual workload, time and thus financial costs. A DSS provides relevant information about a particular situation helping the managers make better and informed decisions. It is usually used to solve specific and strategic problems involving complex models, although they can also be implemented using spreadsheets (Alturas, 2013).

Database Implementation

To accommodate a DSS, you need a database system (DBS) which is “a computerized record keeping system with the overall purpose of maintaining information and making it available whenever required” (Foster & Godbole, 2016, p. 3), in order to store and manipulate all its information.

According to Foster & Godbole (2016) a DBS has the following main components:

- Hardware and operating system
- Database Management System (DBMS)
- Database
- Related software systems / applications
- Users (technical and end-users)

Figure 3 is a simplified representation of how these components relate to each other:

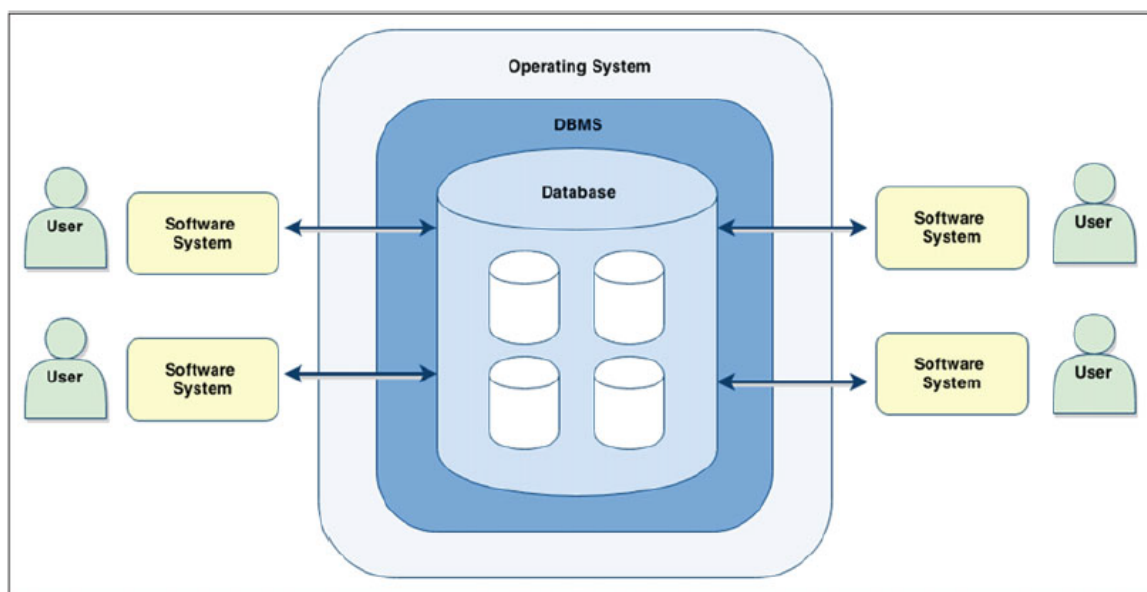


Figure 3 – Simplified representation of a DBS (Foster & Godbole, 2016, p. 4)

A DBS allows to achieve multiple goals, that by themselves are some of the most important DBS's advantages:

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- Protection and security of your data
- Manipulating your data through multiple users at the same time
- Flexibility in obtaining data through different methods
- Availability to access and manipulate data
- Data integrity, accuracy and consistency
- Standardization of data
- Reduction of redundancy
- Improved performance
- Logical views of data (Foster & Godbole, 2016).

Until now, there have been three main approaches in designing a DBS:

- Using conventional files
- Using databases with hierarchical or network models
- Using databases with relational or object-oriented models.

For this last one, object-oriented models “have been replaced by more contemporary approaches such as the EAV model, Hadoop and NoSQL” (Foster & Godbole, 2016, p. 10) Regardless, the relational model is the most widely used nowadays, mainly because “it is firmly founded on mathematical principles (set theory and linear algebra) which have been tested and proven; like the underlying principles, the model itself has been tested and proven over the years” (Foster & Godbole, 2016, p. 37).

The most common language used for DBMS products is the Structured Query Language (SQL) since its standards are constantly revised, being that its last version is the ISO/IEC 9075-1:2016. It is considered “an interactive query language as well as a database programming language” (Foster & Godbole, 2016, p. 205). Its main advantages are the following:

- Rapid Software Development: It is very powerful and easy to learn, enhancing the rapid development of application systems;
- Higher Software Quality: Due to having powerful statements that other high-level languages don't have, it can decrease the size of the code, hence, the probability of

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error;

- **Higher Productivity:** SQL has some features that are very difficult to find in other high-level languages, and these include: fast access to data, easy to aggregate data, commonly used commands to enforce data integrity and data security restrictions (called constraints);
- **Data Independence:** The data is separate from the applications, making it easier to perform data and application maintenance, or other intrusive actions, without affecting the other layer; It also allows for different applications, or different sections of the same application, to have different logical views, adapted to the requirements of each one;
- **Standardization:** Facilitates the development of competing tools since they all have to support the same language (Foster & Godbole, 2016).

Regardless of the used approach, the development of a database should go through the steps described in Table 1:

DDLC Phase	Related Deliverable(s)
Database Investigation and Analysis	Initial Database Requirements
Database Modelling	Database Model
Database Designing	Database Design Specification
Database Development	Actual Database
Implementation	Actual Database in Use
Management	Enhanced Database; Revised Database Documentation

Table 1 – Database Development Life Cycle (Foster & Godbole, 2016, p. 12)

In the database investigation and analysis phase, the main task is to gather information about the requirements that need to be implemented in the database. Some of the most common methodologies used are interviews, questionnaires, surveys, observation, sampling and document review. In the end of this phase there should be no doubts about the goals to be achieved when implementing the database (Foster & Godbole, 2016).

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In the database model and design phase, the goal is to create a representation of the database, usually through the design of an Entity-Relationship (E-R) or a Unified Modelling Language (UML) model. These models should define the existing entities, the way they related to each other and their individual attributes (Foster & Godbole, 2016).

In the development and implementation phases, the database is implemented according to the previous defined model. Typical activities of this phase are creating the database's tables, populating them with data, creating constraints and validating data (Gupta, Mata-Toledo & Monger, 2011).

The management phase is dedicated to the maintenance of the database itself when it is already fully operational. It includes rebuilding indexes history and logs cleansing and data integrity validations. It may also involve new enhancements or the implementation of new functionalities.

Not only the database itself needs to be implemented, but also the front-end that links the user to its data, allowing him to view and edit it. Both are usually linked through already developed suites that can be configured and completed with the specific functionalities of our system. Some examples of these suites are the following:

- Microsoft SQL Server: Proprietary relational DBMS developed by Microsoft since 1989;
- MySQL: Open-source relational DBMS since 1995, now owned by Oracle;
- DB2: Proprietary relational DBMS developed by IBM since 1983;
- Oracle Database: Proprietary relational DBMS developed by Oracle since the 1980s.

Part II – Planning

The plan for this project was divided in four phases:

1. Requirements gathering;
2. Modelling;
3. Prototype development;
4. Tests and final approval.

In the first phase, the goal is, basically, to understand the evaluation process of employees' performance as it is, and its current issues that should be fixed with this project. We also need to be aware of the difficulties and problems we have to solve. The strategy to achieve these goals includes interviews with various stakeholders: directors, decision makers and employees.

The results of the first phase will be the basis for the second phase, which consists in modelling the system using UML 2.0 diagrams.

The first is a Use Cases diagram that reflects the collected requirements. The Use Cases diagram is very useful to confirm with the stakeholders the validity and correct interpretation of the requirements gathered in the first phase, when converted in features. The next diagram is a conceptual class diagram that represents the system's classes of objects, their attributes and the way they relate to each other. The goal is to define the system's structure and also to validate the requirements in more detail. The final diagram is the relational class diagram, which is an adaptation of the former diagram with more technical nuances of how it will be implemented in the system.

After the model is approved by the stakeholders, the development phase starts, where all or part of the identified requirements are implemented. The system was first implemented in Microsoft Excel (ME) using Visual Basic for Applications (VBA), and later in Microsoft Access (MA), also using VBA, and Microsoft SQL Server (MSS). In the final phase user tests are conducted and possible improvements to the implemented features may be necessary, depending on its results.

Part III – Exploration

Understanding the Main Issue

The institution for which this project is aimed to (Núcleo de Instrução e Beneficência de Paço de Arcos – NIB), is an IPSS, running mainly on public funding. Since the rise of the economic crisis, the certainty of the continuous funding decreased greatly. This triggered the institution's management to consider new strategies to keep the funding from coming in. One of the agreed strategies was obtaining the ISO 9001 Certification, and since the Portuguese State tends to benefit institutions that have proven their value, management felt pretty strongly that this certification would give that proof.

After analysing the requirements for ISO 9001, one particular section came to focus: Clause 9 – Performance evaluation. NIB never had a performance evaluation system implemented, so this was a top priority task. This would not only improve the chances of maintaining public financing, but would also help improving the institution's service quality, which could attract more families on signing in their children, ensuring the continuity of the institution.

The next phase consisted in designing a system for the evaluation of the employees' performance that could fit the NIB's needs. Since this was the first year of its implementation, much work needed to be done:

- Define the evaluation process;
- Design an evaluation method;
- Decide what to evaluate;
- Decide what to do with the results.

While the majority of these tasks are not suited for a Computer Systems student, after they were finished, the pedagogical director identified some issues that she was not able to solve.

So, there was an interview with the pedagogical director, to understand what were the main issues to be solved in this project. It was concluded that the designed process for the evaluation of employees' performance had many flaws, especially regarding time and labour for the pedagogical director.

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To be more specific, the main challenges were the following:

- Make the process intuitive for everyone involved: evaluated employees, evaluators and decision makers;
- Create evaluation forms promptly and in an easy way;
- Make evaluation forms easy to perceive and to fill for both evaluated and evaluators;
- Save all evaluations' data in an instant and in a way that it can be easily accessed and viewed;
- Generate reports with relevant data regarding the evaluations' scores;
- Achieve all goals with no expenses.

With these issues, the main objectives of the IS were identified.

The Evaluation Process

The evaluation process was defined by the directors, and adapted from SIADAP's legislation to the institution in study. The result is shown in Figure 4.

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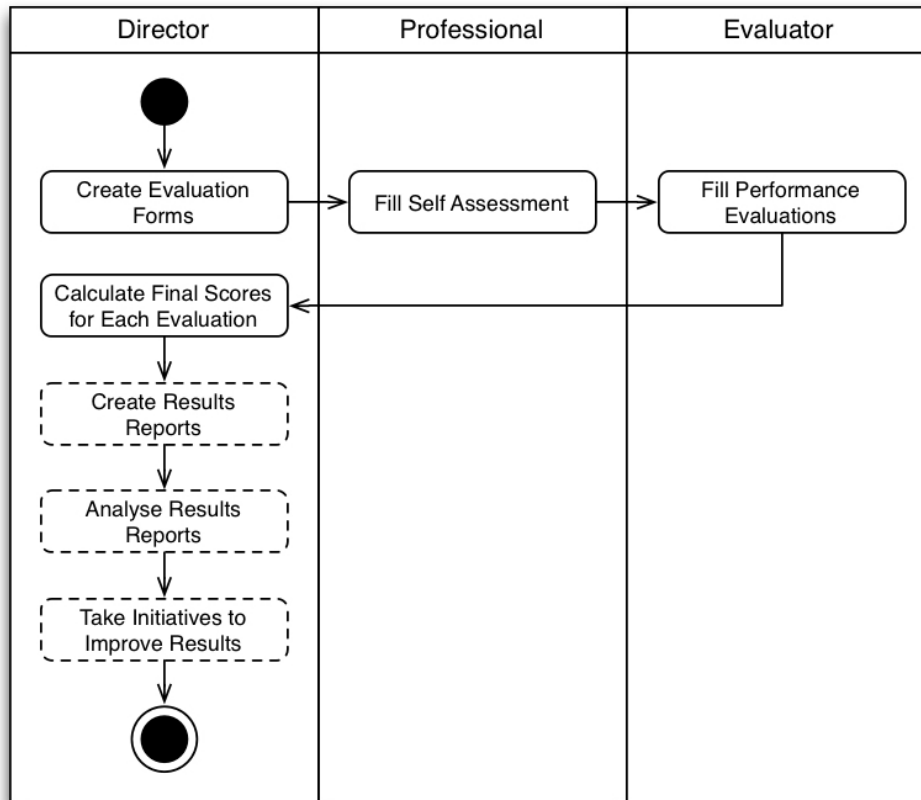


Figure 4 – Process Flow without IS

The evaluation process' flow starts with the creation of the performance evaluation form, which will be different for each professional category – in SIADAP, evaluations are different for each person, but for now, the pedagogical team decided to differentiate the evaluation topics only by category. The forms are then printed and distributed to each professional so they fill it with the respective self-assessments. After this step, the evaluators finish filling the form with the evaluation itself. The director should then receive all finished evaluations, calculate the final scores for each of them and create reports with the results so they can be analysed. This analysis will then be the foundation to design future initiatives that aim to improve their results.

However, these last four activities are very labour intensive and time consuming for someone that has many other responsibilities within the institution, like is the case of the pedagogical director. Like she said, this means that, without some help, these tasks – the last three activities, for sure – would probably fall into oblivion, nullifying the goals of the whole process.

The Evaluation Structure

Regarding the performance evaluations themselves, they were designed by the school's pedagogical team, also based on the SIADAP's legislation, to serve their best interests. Each evaluation is composed of three types of questions:

- Transversal, which will hold all topics regarding a set of skills that will apply to any professional category;
- Specific, which will hold all topics regarding each professional category specifically;
- Goals, which will hold all goals for each professional category specifically.

All topics will be evaluated through indicators (or items) using Likert scales between 1 and 5, considering that 1 corresponds to "Never" and 5 to "Always". Specifically for goals, the employee can accomplish it or not, corresponding to a score of 5 and 1 respectively.

The topics regarding the transversal evaluation will be divided in 6 different groups of skills:

- Professional autonomy: where professionals are evaluated regarding their skills in being autonomous and professional in their assigned tasks and responsibilities';
- Interpersonal relationship: where professionals are evaluated according to their skills in relating to other co-workers of all areas;
- Communication: where professionals are evaluated regarding their communication skills towards co-workers and customers (children and parents);
- Personal development: where professionals are evaluated considering their will and commitment in learning and applying new skills on the job;
- Discipline and work commitment: where professionals are evaluated regarding their commitment to their work and discipline according to the schools' values;
- Change and innovation: where professionals are evaluated concerning their skills in proposing new ideas and finding new solutions to problems in the workplace.

For a more detailed view of the topics used in this work, please check the evaluations' questions in Appendix A.

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In Figure 5 the classification of the evaluations' questions is represented by a self-explanatory diagram.

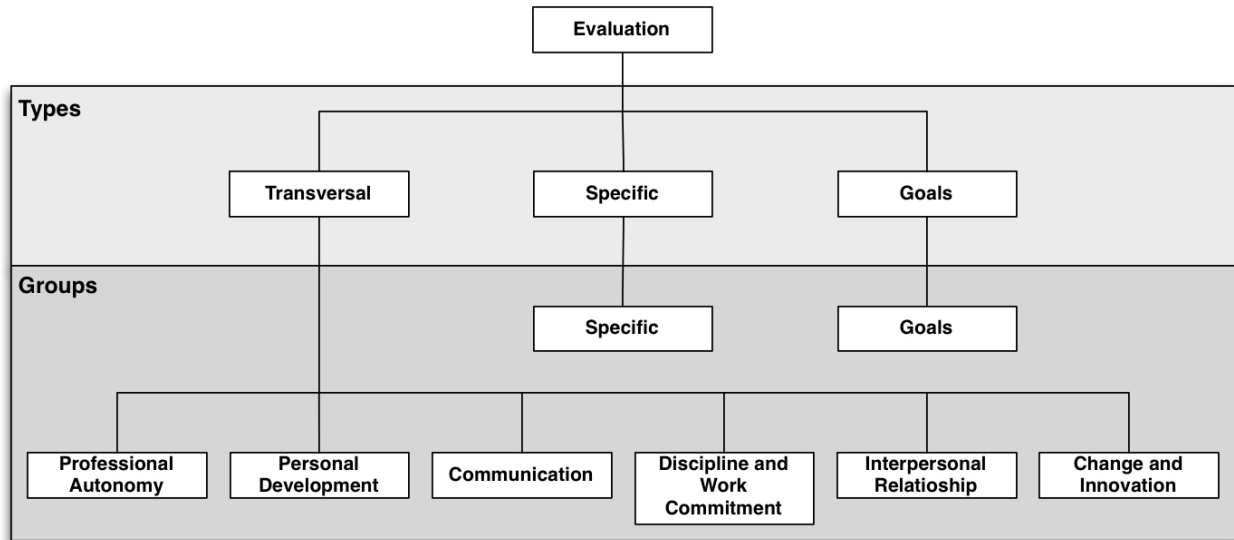


Figure 5 – Classification of evaluations' questions by types and groups

The final scores are calculated using a weighted average. Each type of questions has a specific weight, and all questions of a specific type contribute to its simple average. For example, if types Transversal and Specific have a weight of 30% and Goals has a weight of 40% and each group has a simple average of 4, 5 and 3 respectively, the final evaluation score would be $(4*0.3) + (5*0.3) + (3*0.4)$, i.e. 3.9. The same logic is applied to the final self-assessment score.

Requirements Gathering

After understanding the evaluation process flow, the requirements gathering phase started, giving special attention to what an IS could do to improve the process. The first issue that the IS can help, is to automate the first activity of the process (cf. Figure 4).

For this to occur, the evaluated professional should access the IS and identify the professional category for which he wants to fill the form. The next two steps in the process will happen with no changes. The calculation of the final scores for each evaluation, however, can be automated in the system itself, relieving the director of this task.

The next improvement that the IS can add to the process is to enable its last three activities.

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The IS will generate the final reports after the system administrator indicates that should be done. This automation should greatly diminish the time and labour done by the directors and enable them to proceed with the last two activities of the process.

With both these functionalities implemented in the system, the process flow changes to the one shown in Figure 6.

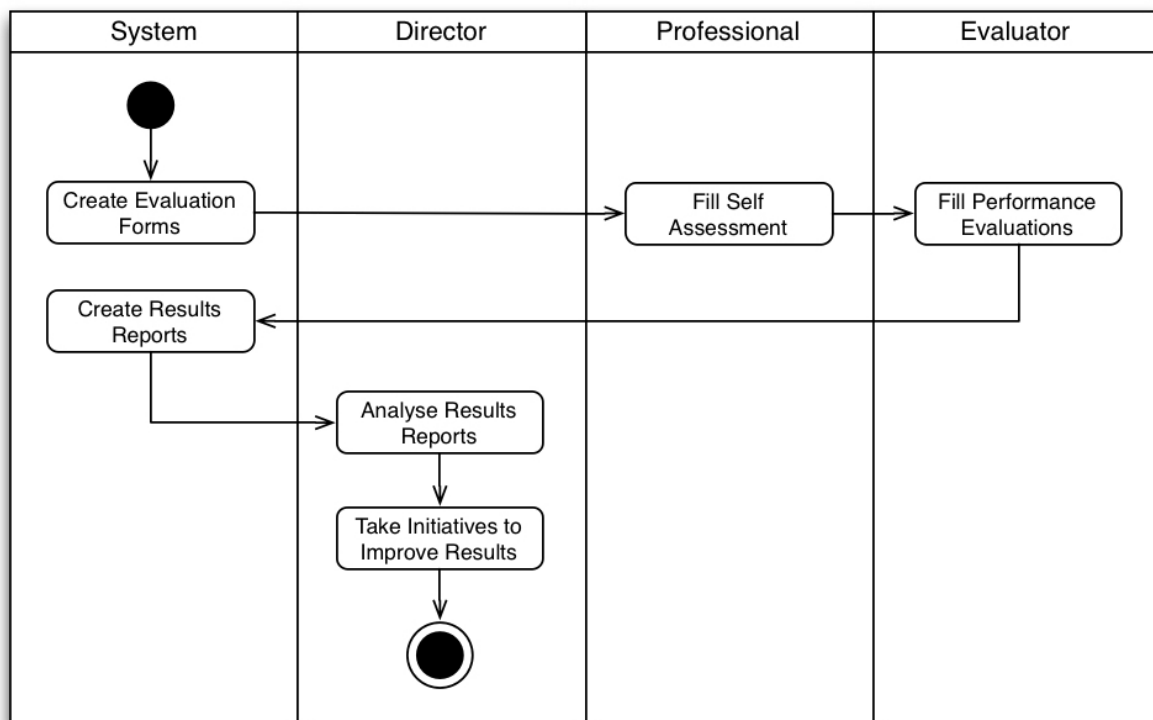


Figure 6 – Process Flow with IS

The generated reports should include relevant data to the decision makers, which include averages, counts or comparison through the years, for the self-assessment and the scores of the employees' performance evaluation, as well as the discrepancies between them, as was asked during the stakeholders' interviews. Having this into consideration, the proposed reports are the following:

- Averages of self-assessment, evaluation of performance or score discrepancies for a given school year by the following dimensions (these can also be combined in sets of two):

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- Overall;
- Evaluation type;
- Evaluation group;
- Category;
- School centre.
- Number of evaluations by self-assessment or evaluation score for a given school year by the following dimensions:
 - Overall;
 - Evaluation type;
 - Evaluation group;
 - Category;
 - School centre.
- Comparison of a measure of a given school year to the previous five years. The compared measures can be any of the ones described in the previous bullets.

These should be the Key Performance Indicators (KPI) that will ultimately help the decision makers understand the quality of their employees and intervene with the necessary actions to improve the service provided by the school³. Besides the addressed topics, the IS should also be able to access and manage (add, update or delete) all relevant information.

In addition to the requisites described above, there were other secondary functionalities that were brought up in the interviews with the stakeholders:

- Manage the system's data;
- Change the calculation weight of each questions' type;
- View all the information of an evaluation;
- View the list of missing evaluations for a given year;
- Available users for every professional so they can log in the system to perform their self-assessments and evaluations, as well as administrator users to manage all the data.

³ For a more extensive description of the KPIs, please view Appendix B.

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The relevant information that needs to be stored includes the following:

- School years: description;
- School centres: description (General, Kindergarten or Nursery);
- Class rooms: name, associated school centre and school year;
- Professionals: name, associated school years, class rooms, categories and evaluations.
- Categories: description and evaluator flag;
- Evaluations: school year, evaluated professional, evaluator, self-assessment date, evaluation date, self-assessment score, evaluation score, evaluated professional comments, evaluator comments, associated questions and their scores.
- Questions: question, associated category and evaluation group;
- Types: description and weight;
- Groups: description and associated type;
- Users: user, password, associated professional and administrator flag.

Part IV – IS Modelling

Requirements Representation

In this chapter, the system's functional requirements are represented in a UML use cases diagram (cf. Figure 7) emphasising the way they relate to each other and their stakeholders.

The requirements' correspondent actions are represented by oval boxes called use cases, and stakeholders are represented by stick figures called actors. The system's use cases are inside a box that represents the system, all use cases outside the box are external to the system. The actors connect to the use cases that they intervene in directly.

Use cases related by "include" connections have a dependent relationship, meaning that the first one depends on the second one to be achieved. Actors can also be related to each other, in this case by generalization connections, represented by triangle arrows. These relationships describe actors that can have different roles, for example a professional can be evaluated and can also be an evaluator.

In the following paragraphs, each use case is described in more detail.

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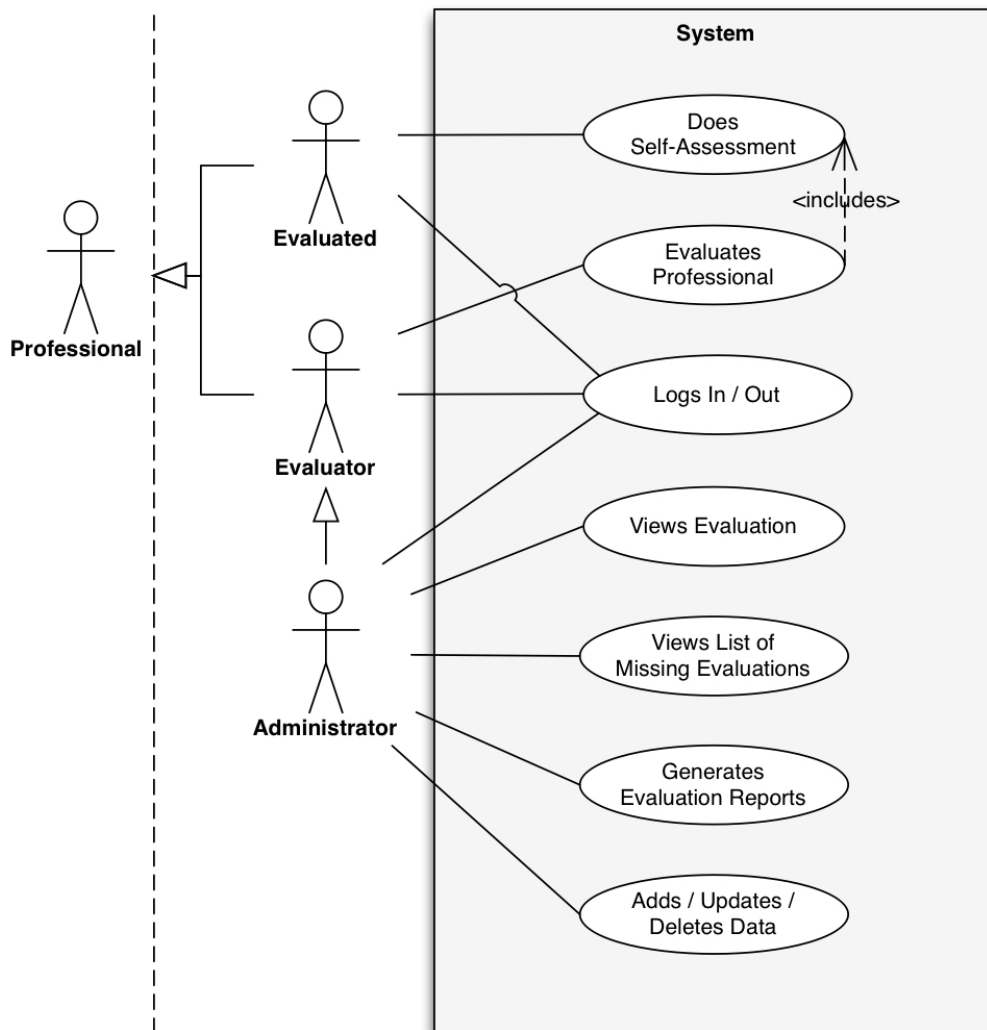


Figure 7 – Use Cases Diagram

The system's functional requirements are the following (cf. Figure 7):

- **Log In / Out**: Every user can enter the system by inserting its credentials, and according to the user type (administrator, evaluated or evaluator), it will have access to the respective functionalities. The user can also log out from the system;
- **Does Self-Assessment**: After the system presents the correspondent evaluation form, the evaluated fills it with its self-assessment;
- **Evaluates Professional**: After the self-assessment is done, the evaluator completes the form by filling it with the professional evaluation;

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- Views Evaluation: The system should be able to show every detail of an evaluation selected by the administrator;
- Views List of Missing Evaluations: The system should be able to present a list of professionals that have missing evaluations in the system for a given year selected by the administrator;
- Generates Evaluation Reports: The system should be able to generate Excel files with the proposed reports in section “Requirements Gathering”, representing the evaluation results for a given year selected by the administrator;
- Adds / Updates / Deletes Data: The system should be able to add, update or delete data from the database anytime the administrator requests so.

For a more detailed description of each use case, please check Appendix C.

To achieve all the functional requirements, the system must be connected to a database that can accommodate the evaluations described in section “The Evaluation Structure”. A database will collect all the systems’ data in a structured way, enabling the system to access the information needed for every action it takes. Therefore, this database must store information about:

- The school: school year, school centre and class rooms;
- The professionals: professional name, class room and professional category assigned to in each year;
- The evaluations: evaluator, evaluated, questions and their correspondent type and group, self-assessment and evaluation score for each question and self-assessment and evaluation final grades and their dates;
- The users: users, passwords, indication of administrator and associated professionals.

In Figure 8 we may observe the conceptual classes diagram representing the entities that will be stored in the database, as well as their corresponding data (or characteristics).

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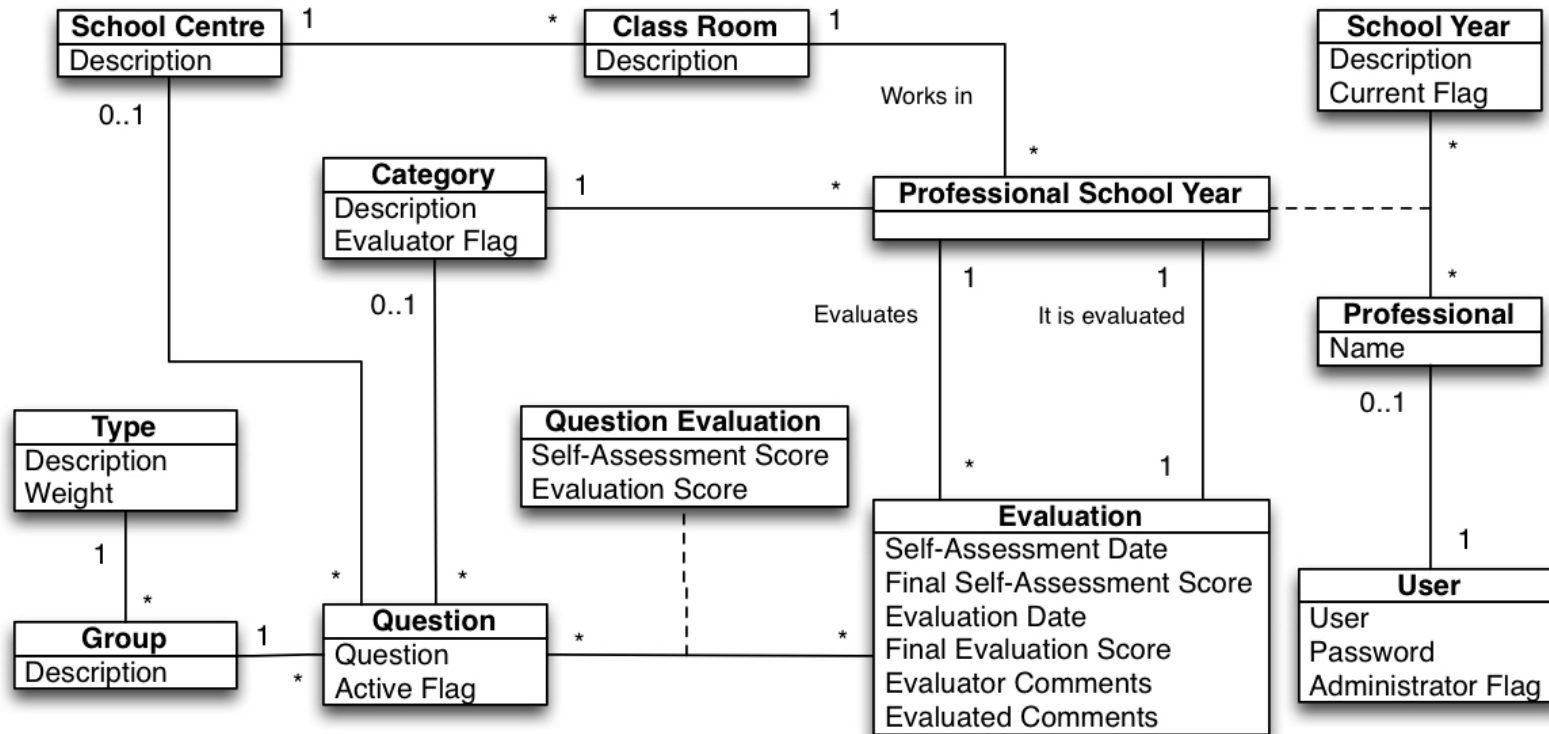


Figure 8 – Conceptual Classes Diagram

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The conceptual classes diagram represents the relationships between all the entities in the IS.

In each school year, every professional can have a different category and it may be assigned to a different class room of any school centre. To accommodate this requirement, there is an association class – Professional School Year –, representing each professional in each year. Furthermore, categories indicate if its professionals can evaluate others, according to its evaluator flag. For example, if only categories “Pedagogical Director” and “Financial Director” have the evaluator flag set to true, this means that only professionals associated to these two categories can evaluate, in the respective year where that happens. If a professional that has the category “Pedagogical Director” in a year, changes it to “Educator” in the following year, he can’t perform evaluations in that following year.

Every evaluation is related to two professionals: the one that evaluates and the one that is being evaluated. Since each evaluation refers to a school year, where each professional has its own characteristics, the evaluation relates to Professional School Year. All professionals of a given year are evaluated once, including evaluators, whom cannot evaluate themselves.

In addition to the professionals, each evaluation also has its own dates, multiple questions, scores and comments. For this, there are several attributes in the evaluation class, and a different class that contains all questions. Each question can be related to a different number of evaluations, since each evaluation contains questions depending on the school centre and category of the professional being evaluated. Therefore, a question has an evaluation score and a self-assessment score for each evaluation that it is related to. The associated class “Question Evaluation” represents this concept, including its scores.

Evaluation questions can be classified by type and group, as described in “The Evaluation Structure” chapter. Classes “Type” and “Group” are used in the diagram to represent this requirement. For the cases when some questions cease to be valid for new evaluations, their active flag should be changed to false, which can be changed back whenever the administrator wants.

Transversal questions are mandatory to every evaluation, since they are applied to all categories of every school centre. Questions of the specific and goals types are applied to a concrete

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category in a school centre. Therefore, specific and goals types questions are related to a school centre and a category, whilst transversal type questions don't need to have these relationships because they apply to all.

Each professional has to have a unique user to access the system and the correspondent password. In addition to the professional's users there are also administrator users, which are not associated to any professional and have the administrator flag as true.

Lastly, there can only be one school year at a time for which the system lets its users perform self-assessments and evaluations. The administrator can indicate which one through the current flag.

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IS Model

For the IS itself and its database, the class diagram was transposed to the relational schema below. using the standard rules described by Alturas (2013), Ramos (2007) and Nunes & O'Neill (2004). Primary keys are underlined and foreign keys are *italic*. A detailed definition of primary, foreign, simple and composed keys can also be found in the previously mentioned references.

Category (ID Category, Description, Evaluator Flag)

Class Room (ID Class Room, *ID School Centre*, Description)

Evaluation (*ID Evaluated*, *ID Evaluated School Year*, *ID Evaluator*, *ID Evaluator School Year*, Self-Assessment Date, Final Self-Assessment Score, Evaluation Date, Final Evaluation Score, Evaluator Comments, Evaluated Comments)

Group (ID Group, *ID Type*, Description)

Professional (ID Professional, Name)

Professional School Year (*ID Professional*, *ID School Year*, *ID Class Room*, *ID Category*)

Question (ID Question, *ID Group*, *ID School Centre*, *ID Category*, Question, Active Flag)

Question Evaluation (*ID Evaluated*, *ID Evaluated School Year*, *ID Question*, Self-Assessment Score, Evaluation Score)

School Centre (ID School Centre, Description)

School Year (ID School Year, Description, Current Flag)

Type (ID Type, Description, Weight)

User (ID User, *ID Professional*, User, Password, Administrator Flag)

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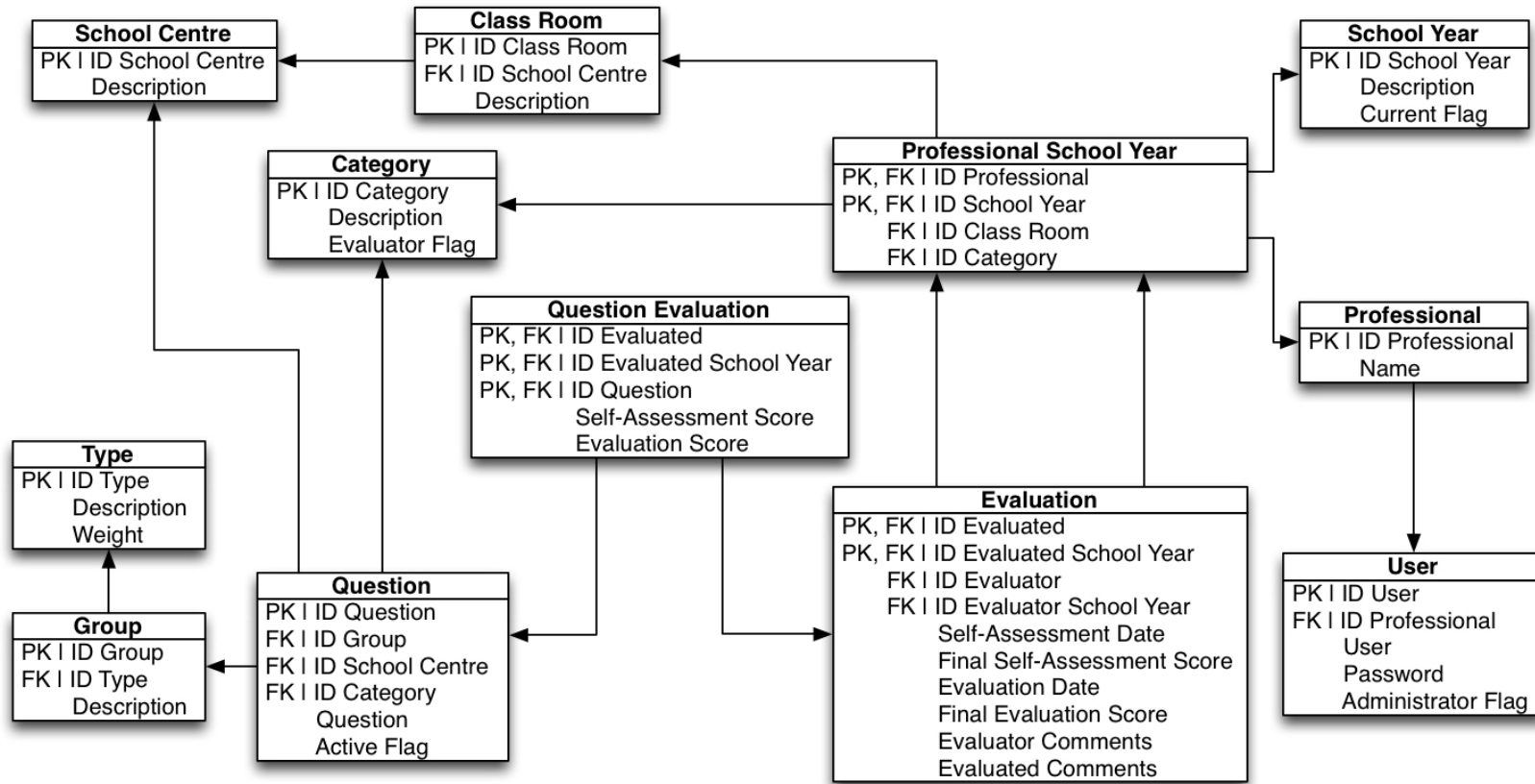


Figure 9 – Relational Diagram

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Some of the previously described requirements are not completely secured with the designed model. For this reason, the implementation of the model will have to further guaranty the following restrictions:

- Only one school year at a time can be set as current.
- A professional cannot evaluate himself;
- All specific and goals questions must be associated to a single combination of category and school centre, and the transversal questions should be associated to all combinations;
- Transversal and specific questions' self-assessment and evaluation scores must be an integer between 1 and 5 inclusive, whilst goals questions' only valid scores are 1 and 5;
- The evaluations' final self-assessment and evaluation scores must be between 1 and 5;
- An administrator user cannot be associated to a professional, whilst every other user must be associated to one.

Part V – Prototype Development

Implementation

The first important task we faced considering the implementation of this prototype, was to decide which technology should be used. This would have to be a technology that:

- Is easy to use;
- Can be quickly taught to people that have no experience in using computers;
- Has no additional costs;
- Can be used to achieve all project goals.

Other than having to meet these requirements, the decision had no interference by NIB, since the directors' knowledge of information systems was very limited.

After studying the requirements and also taking into account the knowledge and experience we had of the various possible technologies for this project, two solutions were considered: Microsoft SQL Server (MSS) as database and Microsoft Access (MA) as front-end; or Microsoft Excel (ME) as both.

The first option chosen was ME, mainly because NIB already had a license for the software (no additional costs had to be applied), no additional installations would be necessary and some of the employees already knew how to make basic calculation in ME. Also, there are 39 employees in the institution, so it is not expected that the database will need to store an excessive amount of data. Visual Basic for Applications (VBA) was used for macro programming and implementing user forms as the system's user interface, and simple ME worksheets were used as objects for storing the system's information.

Although the institution agreed with the chosen option, the implementation of the prototype using only ME and VBA proved to be too simplistic, containing many limitations to the implementation of the designed model and thus creating data consistency problems. For this reason, and for many others already discussed in chapter "Database Implementation" with the advantages of SQL, a new prototype was developed using MSS to store and manage the data. The user interface was implemented using MA along with VBA programming, since its

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integration with an Open Database Connectivity (ODBC) is very fast and simple and also allows for a web integration. Even so, the first prototype was helpful to understand the requirements and limitations of the users with the initial users' tests.

The implemented functionalities were the following:

- Professional and administrator users: log in and log out;
- Professional user: perform self-assessment for the current school year;
- Professional user that is evaluator: Perform evaluation for the current school year;
- Administrator user: view the details of an evaluation;
- Administrator user: view list of missing evaluations for a specific school year;
- Administrator user: generation of statistical reports (only average and counts) regarding the evaluations;
- Administrator user: adds / updates / deletes data regarding school years, class rooms, categories, professionals and questions. This functionality also includes managing school years, categories and class rooms assigned to professionals and changing the weight of questions' types in the scores calculation.

For a better understanding of how these functionalities work, view the implemented user interfaces in Appendix D or the demonstration video available as a multimedia content (CD) for this work. Some examples of reports are also represented, using dummy data, in Appendix E.

To implement the restrictions that were not tackled by the designed model, check constraints and unique indexes were used. Also, the creation of professionals' users was implemented using a trigger that automatically creates and inserts a new user in the database, every time a new professional is created. The user string consists of the professional name with trim spaces and the password is the same for every user. For the user to never be duplicated, a unique constraint was applied to the name of the professionals. Regarding the passwords, we recognize that there is a safety issue, but for the purpose of this prototype this issue was not addressed. For a better understanding of the implemented restrictions, please check Appendix F.

User Tests

The user tests were performed in two phases, the first one testing the first prototype developed in ME and the second one testing the second one developed in MA and MSS. In each phase, the user tests were divided in two groups: testing the evaluation form filling and testing the functionalities designed for administrator users.

The first group was tested, individually, by four different employees that had different levels of experience using ME. Each one had a two-part session: in the first part, the user attempts to fill the evaluation form without having a pre-explanation of how the form is structured, and in the second part the form is explained and the user follows with the narration of its experience in the first part of the test. The goal of this experience was to test if the IS was intuitive enough for the user in the first part, and discuss it in the second part.

The first employee was an experienced ME user, the task at hand was very fast and easy to achieve. The second employee was not as experienced as the first one, but knew how to use the basic functionalities of ME. The only difficulty found was an understanding of the used scales. The solution for this issue was to include a scale explanation in the evaluation form.

The third employee knew of ME but didn't use it. The first difficulty was to find the questions to evaluate, since they were in different worksheets. The solution for this issue was to add a "Next" button in each worksheet that changed to the next one whenever it is clicked. The fourth employee had never work with ME and did not have much experience using computers. In addition to the issues found by the previous testers, this employee also had problems understanding how to use a *combo box* do chose the intended score. The solution found for this was to replace the *combo boxes* with *check boxes* where all available scores are visible, and the user can choose the intended one in a more intuitive manner.

For the second group of tests, the test was carried with the pedagogical director in a similar way as the first, with two-part sessions where all the implemented functionalities were tested.

In the first part, the user was given a list of tasks to perform without having a pre-explanation of how the IS worked. The second part of the testing session started with a detailed description

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of how each functionality should be used, and was followed by the user's narration of the experience in the first part of the session, as well as suggested improvements for the IS.

In the first part of the session the user recognized and used most functionalities immediately with no problems. The only functionality where the user had issues was on adding / updating / deleting data: it was not clear to her where she would do it for school years, class rooms and categories. In the tested version of the IS the following steps should be made to achieve the task "Add a new school year":

1. Start the program: which shows a button labelled "Begin";
2. Click the button "Begin": which shows a window with the buttons "Data", "Evaluations" and "Reports" (cf. Figure 10);
3. Click the button "Data": which shows a window with the buttons "School", "Professionals" and "Questions" (cf. Figure 11);
4. Click the button "School": which shows a window with the buttons "School Years" and "Class Rooms" (cf. Figure 12);
5. Click the button "School Years": which shows a window with a list of all categories in the database and buttons "Add", "Update" and "Delete" (cf. Figure 13);
6. Click the button "Add": which shows a window with an empty textbox labelled "School Year" and buttons "Add" and "Cancel" (cf. Figure 14);
7. Fill the textbox with the new school year and click the button "Add".

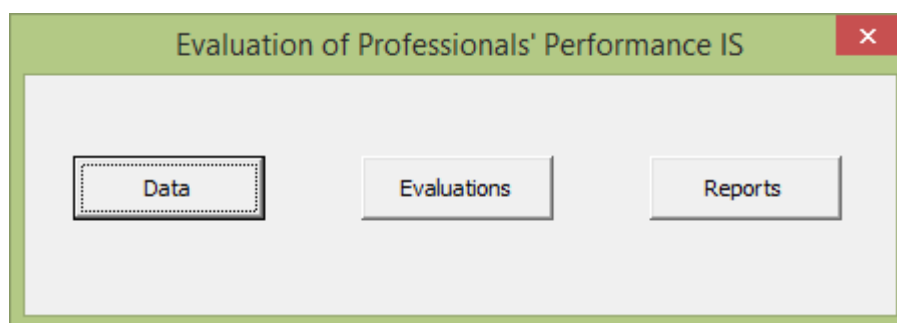


Figure 10 – ME Prototype: Start Interface

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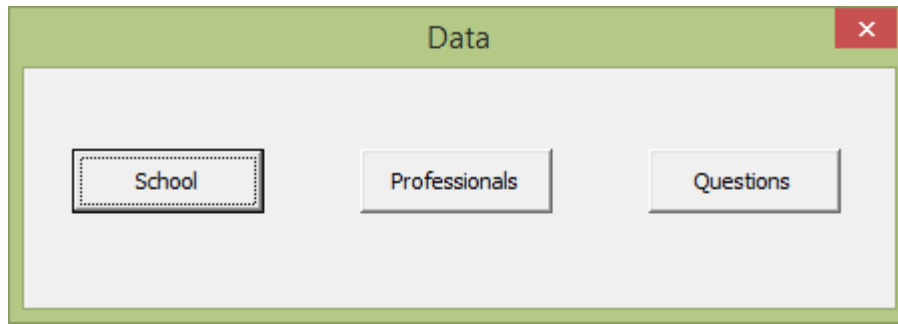


Figure 11 – ME Prototype: Screen Shown when Clicking the Button “Data” from Figure 10

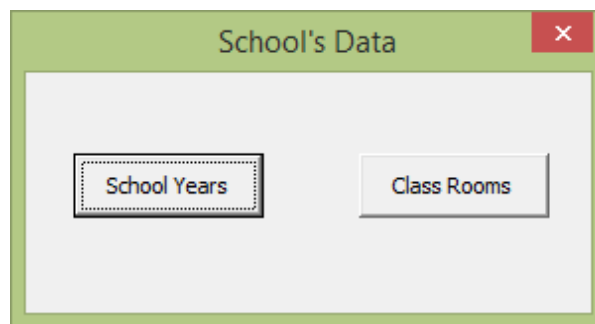


Figure 12 – ME Prototype: Screen Shown when Clicking the Button “School” from Figure 11

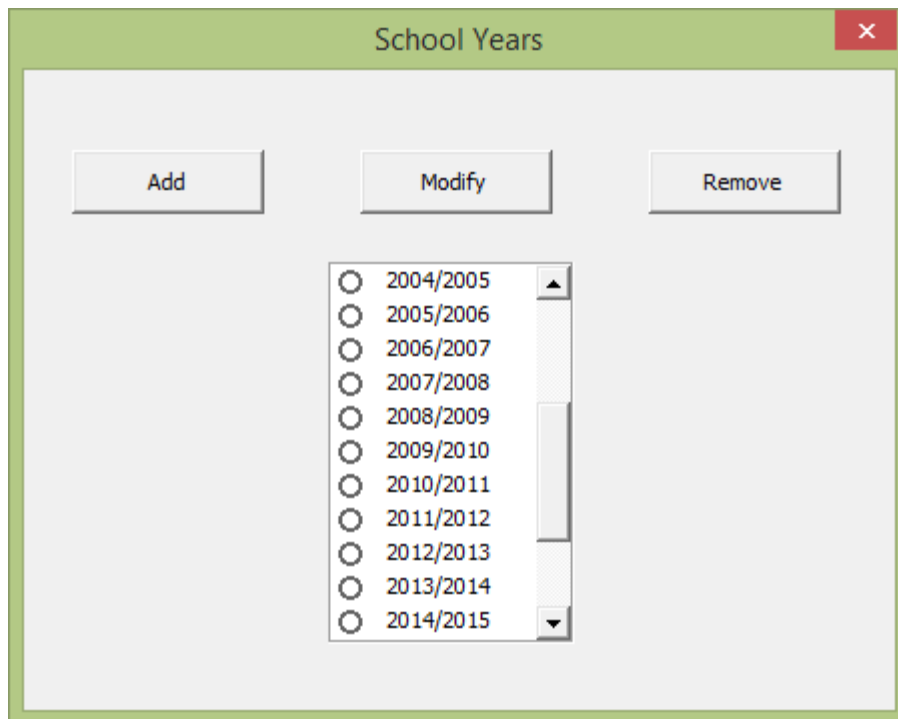


Figure 13 – ME Prototype: Screen Shown when Clicking the Button “School Years” from Figure 12

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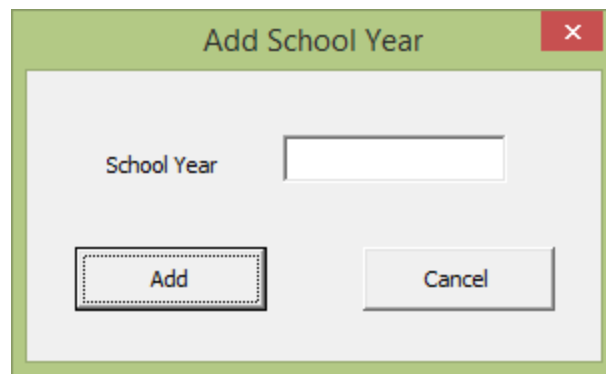


Figure 14 – ME Prototype: Screen Shown when Clicking the Button “Add” from Figure 13

The user was stuck on step 3, since she wasn't sure where “School Year” would be. The same experience happened when trying to achieve the same task for class rooms and categories. However, on the task “Add a new professional” she had no problems, and went back to achieve the firstly failed tasks after realizing where the buttons were included.

On the second part of the session, after the detailed description of the IS, the user described her difficulties and discussed possible changes to make the experience more intuitive. We agreed that there shouldn't be so many steps to achieve a single goal in the IS (cf. Appendix D).

In the second phase, regarding the tests of the MA and MSS prototype, the problems identified in the first phase had already been addressed. In the first group, there were no issues when the users were asked to perform the self-assessment. However, some users were confused when trying to perform the evaluation of another professional. The screen shows a list of professionals to choose from, to make the correspondent evaluation. This list only shows professionals that have already made their self-assessments but hadn't been evaluated yet (cf. Figure 15), and after the evaluation is terminated, the respective professional no longer shows in this list. After discussing the issue with the users, we concluded that a list of all professionals indicating the status of the evaluation would be more comprehensive (cf. Appendix D).

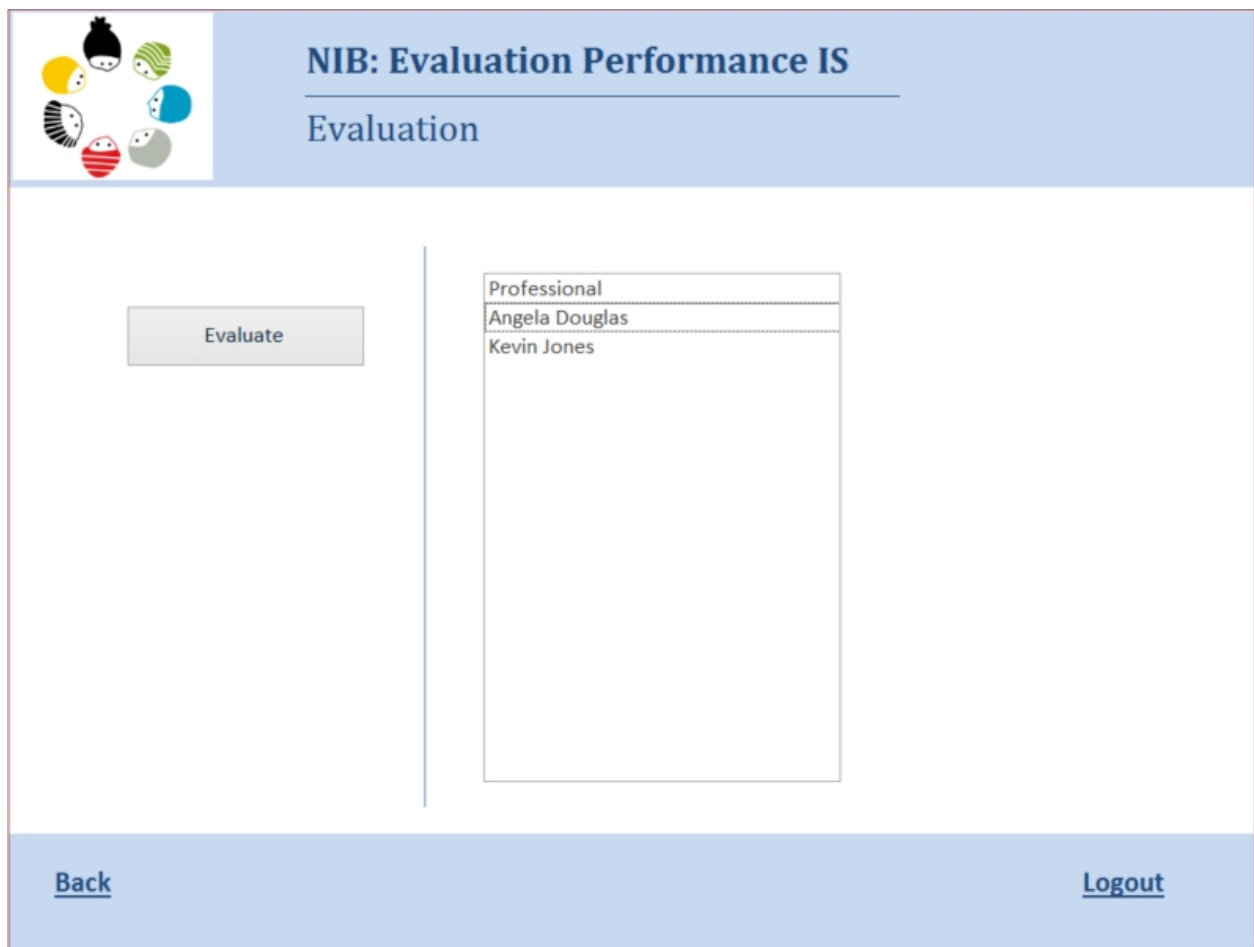


Figure 15 – MA and MSS Prototype: Screen Showing the List of Professionals to Evaluate

In the second group, the pedagogical director had no problems performing her tasks. However, a new requirement was defined for the IS, which was to permit the evaluated professionals to view their evaluations in the system, after they were concluded by the evaluator. Taking into account the stage at which this work was at the moment, we decided to add this functionality to the future developments list.

Implementation Results

After the first implementation was finished (through ME), the institution's directors asked if it was possible to use the IS functionality of making reports for the evaluations of the previous school year. There was an agreement that they would provide the manually filled evaluations, with hidden names, to respect every employee's right to privacy, and we would insert the results in the IS manually, so the reports could be created.

While inserting the evaluations' scores in the IS, the final results were also being reviewed, since they were calculated manually. In 39 evaluations, 15 had calculation errors, corresponding to a 38% of human error. This revision was approved by the pedagogical director before creating the final reports.

The feedback regarding the final reports, although very positive, allowed for some improvements in the calculation method for the final scores and the results scale.

The calculation method implemented by the institution considered that, in the transversal and specific evaluations, a score of 1 was equivalent to 20% and 5 to 100%, and for the goals, 1 was equivalent to 0% and 5 to 100%. This seemed inconsistent through the evaluations so, for the purpose of the application, two versions of the calculation were implemented. The first one according to the described method and the second one considering that, in all evaluation types, a score of 1 was equivalent to 0% and 5 to 100%.

After the institution's directors analysed the results, they agreed that the second method was more consistent, so that was the one implemented in the final version of the reports.

Part VI – Conclusions

The main goal for this project stands on facilitating the process of evaluation of employees' performance in a preschool. For this to be achieved, we studied the evaluation process and gathered all necessary information and requirements from NIB (Núcleo de Instrução e Beneficência de Paço de Arcos). After that, a use cases diagram was designed to validate all the gathered information with the institution. After a successful validation, the IS model was defined using class diagrams and its correspondent relational schema in order to meet all the requirements. Finally, most of the suggested functionalities were implemented, tested and approved, turning this into a successful project with most of its goals accomplished. These include the most important one: use the evaluation process to improve the school's service by having easy and fast access to relevant data that can help decision-makers to implement the necessary changes.

In the words of the pedagogical director:

The school can see, in an intuitive way, in which areas the employees have better performance, and in which areas they need to work, so that their performance may be improved. The school management can understand what needs to be worked on. The final prototype allowed us to come across some flaws in the designed evaluation form, and subsequently lead us to correct those flaws. Therefore, the prototype is a valuable asset to NIB, since it allows us to have an insight of the school's big picture in terms of strengths and weaknesses. We have already schedule some training sessions that we hope can mitigate some of the perceived weaknesses.

The next steps for the project will be to finish the implementation of some functionalities, as well as to address some new topics:

- Professional users: View the details of all their final evaluations for every school year;
- Administrator users:
 - Create new administrator users;
 - Update users' information;
 - Delete evaluations;

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- Generate time and discrepancies reports;
- Automatically open generated report;
- Change the generated report's name when there is a file with the same name already;
- Address the security issue of the users' passwords and define a process to inform the professionals of their credentials;
- Review and update the implemented rules for foreign keys updates and deletes in the database, according to the users' necessities.

In the future, this project can also be extended to other similar institutions, but it should be noted that all phases of the project should be realigned to the requirements of those institutions. For example, for cases where the performance evaluation is implemented strictly through SIADAP, the IS model would have to be reviewed to allow questions of the Goals type to be assigned to individual professionals and not professional categories like it was implemented in NIB.

We hope that, somehow, our work gives a contribution to preschools, in order to have a more accurate view of what goes on their workspaces. So, in a near future, they may have more important information to promote a good relationship between professionals and children, and, in a deeper sense, to promote a better learning, in the vital process of education, also contributing, to the development of children, in a context even more propitious.

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Appendices

Appendix A – Evaluation Questions

In this appendix, all questions used in the evaluations are listed by type, group, school centre and category whenever they are applicable. These questions were all defined by the pedagogical administration of the school, based on SIADAP.

Transversal Type

Professional Autonomy Group

- Perform your tasks aiming for the highest quality, always taking into account the proposed result and meeting the defined deadlines
- Follow the procedures defined by the institution using the appropriate tools and forms
- Keep your direct supervisor informed of the progress of your work, alerting him in time to any factors that may require his intervention
- Be careful with the Institution's assets, using them correctly and being careful with their equipment's conservation
- Be assiduous (5 – skip work less than 3 times, 4 – from 4 to 7 times, 3 – from 8 to 11 times, 2 – from 12 to 15 times, 1 – more than 5 times)
- Be on time (5 – be late to work less than 3 times, 4 – from 4 to 7 times, 3 – from 8 to 11 times, 2 – from 12 to 15 times, 1 – more than 5 times)

Interpersonal Relationship Group

- Share information and work well as a team
- Establish a good relationship and collaborate with other colleagues not only in your area but also in other sectors

Communication Group

- Establish a good relationship with the children's families, always trying to respond appropriately
- Communicate clearly by adjusting your language to the counterparts
- Be able to listen
- Be able to question

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- Having self-control in situations of confrontation

Personal Development Group

- Show interest in attending training courses
- Show good learning abilities and being able to apply the knowledge acquired in both courses and on job

Discipline and Work Commitment Group

- Understand and guide your work taking into account the Vision, Mission, Values and Quality Policy of the Institution
- Understand the importance of your role in the area in which you work
- Face all proposed challenges with a positive attitude

Change and Innovation Group

- Show ability to solve problems: identify problems, analyze and propose solutions
- Show dynamism in new or routine situations, presenting new ideas and alternative solutions

Specific Type

Kindergarten Educator

- Plan the socio-educational action by elaborating an annual project that takes into account the theme of the educational equipment and the learning goals for the kindergarten
- Manage and integrate the available human and material resources
- Promote child development and ensure that all children reach the learning goals set for their age
- Observe, assess and record the children development
- Identify and direct children with educational needs by drawing up an Individual Plan that reflects the difficulties and educational proposals to overcome those needs
- Organize and keep up-to-date (in a confidential manner) the individual process of each child, according to internal procedures

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- Promote meetings with parents and other educational partners
- Report all information pertaining to the education of the child to its parents and/or guardians
- Take part in festivities and other significant dates
- Participate in other pedagogical actions when requested

Nursery Educator

- Plan the socio-educational action by elaborating an annual project that takes into account the theme of the educational equipment and the learning goals for the nursery
- Manage and integrate the available human and material resources
- Know the Social Security's Quality Manual for Nursery
- Observe, assess and record the children development
- Identify and direct children with educational needs by drawing up an Individual Plan that reflects the difficulties and educational proposals to overcome those needs
- Organize and keep up-to-date (in a confidential manner) the individual process of each child, according to internal procedures
- Promote meetings with parents and other educational partners
- Report all information pertaining to the education of the child to its parents and/or guardians
- Take part in festivities and other significant dates
- Participate in other pedagogical actions when requested

Kindergarten and Nursery Assistant Educator

- Collaborate and support the pedagogical activity of the institution
- Implement the socio-educational plan developed by the educator
- Supervise children at rest
- Help feeding the children, in the playground and in study visits
- Perform the children's hygiene as well as the activity's room, keeping the spaces clean and tidy
- Take part in festivities and other significant dates

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- Collaborate in other non-pedagogical or pedagogical actions, when requested

Pedagogical Director

- Define pedagogical orientation criteria for the functioning of the school year
- Define pedagogical activities
- Conduct the management of all staff regarding the pedagogical activity, promoting meetings and managing substitutions
- Organize schedules, absences and vacations ensuring compliance with deadlines
- Organize extracurricular activities
- Organize study visits and other activities of a playful nature
- Articulate the list of children with the financial director, keeping him informed of changes
- Mediate between staff and Administration, keeping them informed while complying with NIB's regulations
- Prepare the training plan and disseminate training actions alongside the financial director
- Develop pedagogical activities' plans and reports
- Inventory equipment, teaching aids and support structures
- Promote school-community-family integration (reception, meetings, actions and information)

Gym Teacher

- Plan the physical activity's educational action
- Manage and integrate the available resources
- Promote children's development
- Work in partnership with the classroom educators
- Attend meetings when requested
- Take part in festivities and other significant dates
- Collaborate in other pedagogical actions, when requested

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Music Teacher

- Plan the musical activity's educational action
- Manage and integrate the available resources
- Promote children's development
- Work in partnership with the classroom educators
- Attend meetings when requested
- Take part in festivities and other significant dates
- Collaborate in other pedagogical actions, when requested

Kindergarten and Nursery Cook

- Prepare, season, cook and serve food
- Elaborate or contribute in the definition of the menu
- Receive and store the necessary groceries for cooking, complying with the procedures of NIB
- Take responsibility for the preservation of the groceries and prepared foods
- Be responsible for all order registrations, groceries delivery and temperature records
- Perform and watch the cleaning of the kitchen, pantry and equipment

Kindergarten and Nursery Kitchen Helper

- Perform all tasks assigned by the cook
- Clean, wash and cut vegetables, meat, fish and other foods
- Clean facilities, worktops, cabinets and equipment
- Clean the toilet facilities in the locker room
- Collaborate in the cafeteria service and hygiene

Kindergarten General Services

- Ensure the cleaning of common areas (corridors, stairs, park, cafeteria and gym)
- Ensure the cleaning of sanitary facilities
- Perform courier tasks when requested
- Order hygiene and cleaning products necessary for proper operation
- Ensure transportation of food and other products when requested

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Nursery General Services

- Ensure the cleaning of common areas (corridors, stairs, park, cafeteria and office)
- Ensure the cleaning of sanitary facilities
- Perform courier tasks when requested
- Order hygiene and cleaning products necessary for proper operation
- Ensure transportation of food and other products when requested

Doorman

- Monitor the entrance and exit of the Institution, complying with the procedures of NIB
- Perform on-site repairs
- Go to the Food Bank weekly to get food
- Support the cleaning and irrigation tasks of outdoor spaces
- Perform other cleaning, maintenance and delivery tasks when requested

Financial Director

- Monitor, coordinate and supervise all administrative processes (process children, personnel and accounting)
- Articulate the list of users with treasury and the pedagogical director, keeping them informed about any changes
- Mediate between staff and Administration, keeping them informed while complying with NIB's regulations
- Negotiate delivery agreements and as well as products and services rates
- Stipulate investment proposals, requesting the necessary budgets
- Conduct the management of non-teaching staff, promoting meetings and managing substitutions
- Organize schedules, absences and vacations ensuring compliance with deadlines
- Prepare training plans and disseminate training actions alongside the pedagogical director
- Carry out accounts closure and annual budget operations

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Treasury

- Ensure customers' service in a cordial, welcoming and complying with NIB's procedures
- Ensure the customer's database and individual processes maintenance, keeping them updated
- Execute legal administrative tasks according to the existing deadlines (invoice emission, and sending users map to the insurance company)
- Perform treasury tasks according to NIB's procedures
- Perform other administrative tasks when requested

Accounting

- Ensure customers' service in a cordial, welcoming and complying with NIB's procedures
- Classify and post accounting documents, complying with the procedures' deadlines (previous month)
- Check current accounts, make bank reconciliations and issue balance sheets (previous month)
- Perform legal administrative tasks according to the existing deadlines (send presence maps to social security)
- Perform other administrative tasks when requested

Human Resources

- Ensure customers' service in a cordial, welcoming and complying with NIB's procedures
- Ensure the customer's database and individual processes maintenance, keeping them updated
- Perform legal administrative tasks according to the existing deadlines (processing of wages, taxes and their discharge)
- Perform treasury tasks according to NIB's procedures (payment of suppliers, checking invoices, delivery guides and prices)
- Perform other administrative tasks when requested

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Goals Type

Kindergarten Educator

- Every six months, send / submit to the pedagogical director, the monthly plans in digital format
- At the end of January and at the end of June, send / submit to the pedagogical director, the observation / evaluation sheets in digital format
- Send / submit to the pedagogical director, the evaluation of the school year until July 15th
- Participate in (at least) one training action on topics related to pedagogical practice
- Work collaboratively and cooperatively among teachers in two annual projects

Nursery Educator

- Every six months, send / submit to the pedagogical director, the quarterly plans in digital format
- Send / submit to the pedagogical director the Individual Plans in digital format when approved by the parents
- Send / submit to the pedagogical director, the evaluation of the school year until July 15th
- Participate in (at least) one training action on topics related to pedagogical practice
- Work collaboratively and cooperatively among teachers in two annual projects

Kindergarten and Nursery Assistant Educator

- Ensure the implementation of the socio-educational plan
- Participate in (at least) one training action on topics related to pedagogical practice
- Participate collaboratively and cooperatively between classrooms

Pedagogical Director

- Ensure that a minimum of 95% of class activities are completed
- Present to the Administration a quarterly update on the implementation of the Modern School Movement
- Ensure 3 meetings (weekly with the financial director, biweekly with educators and

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monthly with assistant educators)

- Ensure a retention rate of over 95% of children at the end of the school year
- Ensure the participation of educators and assistant educators in external activities in representation of NIB

Gym and Music Teacher

- Develop an annual project considering the educational equipment and the learning goals of the preschool, and deliver it to the pedagogical director in digital format until the defined date
- Observe, evaluate and record the development of the children in a precise and individual way, and deliver it to the pedagogical director until June 15th
- Participate in (at least) one training action on topics related to pedagogical practice
- Participate collaboratively and cooperatively between staff in at least an annual project

Kindergarten Cook

- Ensure that leftovers are minimal and reused for the benefit of NIB if they exist
- Meet the orders' deadlines, so there is no shortage of groceries for the preparation of the menu

Nursery Cook

- Ensure that leftovers are minimal and reused for the benefit of NIB if they exist
- Ensuring the groceries traceability
- Meet the orders' deadlines, so there is no shortage of groceries for the preparation of the menu

Kindergarten Kitchen Helper

- Clean facilities, worktops, cabinets and equipment according to the defined periodicity
- Daily clean the toilet facilities in the locker room
- Collaborate on the cafeteria service and hygiene

Nursery Kitchen Helper

- Clean facilities, worktops, cabinets and equipment according to the defined periodicity

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- Help in reusing leftovers for sales for NIB's benefit

Kindergarten General Services

- Ensure the cleaning of common areas (corridors, stairs, park, cafeteria and gym) according to schedule
- Ensure the daily cleaning of sanitary facilities
- Replace the doorman in his absence

Nursery General Services

- Ensure the cleaning of common areas (corridors, stairs, park, cafeteria and gym) according to schedule
- Ensure the daily cleaning of sanitary facilities
- Help daily in the cafeteria at meal times

Doorman

- Proceed to the necessary repairs, listed in the priority list
- Go to the Food Bank weekly to get food
- Ensures the safe entry and exit of all NIB's users

Financial Director

- Recover at least 70% of the monthly payments in debt
- Ensure the quarterly updating of the monthly processes
- Ensure the monthly update of the waiting list
- Ensure compliance with legal deadlines in the administrative and financial operations of NIB
- Carry out the monthly presentation of accounts (debtors list, balance sheet and bank position) by the 30th day of the following month

Treasury

- Report debts to debtors over 60 days old, every month
- Keep the monthly payment process up to date every three months
- Ensure the monthly update of the waiting list

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Accounting

- Ensure the classification and posting of accounting documents, complying with the deadlines of the procedures (previous month)
- Check current accounts, make bank reconciliations and issue balance sheets (until the 15th of the following month)
- Perform legal administrative tasks, respecting compliance with legal deadlines

Human Resources

- Perform legal administrative tasks, respecting compliance with legal deadlines
- Check invoices to pay budgeted prices

Appendix B – List of Proposed KPIs

1. Average of overall self-assessment score;
2. Average of overall self-assessment score by evaluation type;
3. Average of overall self-assessment score by evaluation group;
4. Average of overall self-assessment score by school centre;
5. Average of overall self-assessment score by category;
6. Average of self-assessment score by evaluation type by school centre;
7. Average of self-assessment score by evaluation type by category;
8. Average of self-assessment score by evaluation group by school centre;
9. Average of self-assessment score by evaluation group by category;
10. Average of self-assessment score by school centre by category;
11. Average of overall evaluation score;
12. Average of overall evaluation score by evaluation type;
13. Average of overall evaluation score by evaluation group;
14. Average of overall evaluation score by school centre;
15. Average of overall evaluation score by category;
16. Average of evaluation score by evaluation type by school centre;
17. Average of evaluation score by evaluation type by category;
18. Average of evaluation score by evaluation group by school centre;
19. Average of evaluation score by evaluation group by category;
20. Average of evaluation score by school centre by category;
21. Average of overall discrepancy;
22. Average of overall discrepancy by evaluation type;
23. Average of overall discrepancy by evaluation group;
24. Average of overall discrepancy by school centre;
25. Average of overall discrepancy by category;
26. Average of discrepancy by evaluation type by school centre;
27. Average of discrepancy by evaluation type by category;
28. Average of discrepancy by evaluation group by school centre;
29. Average of discrepancy by evaluation group by category;

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30. Average of discrepancy by school centre by category;
31. Number of evaluations by final score
32. Number of evaluations by final score by evaluation type;
33. Number of evaluations by final score by evaluation group;
34. Number of evaluations by final score by school centre;
35. Number of evaluations by final score by category;
36. Number of evaluations by self-assessment score;
37. Number of evaluations by self-assessment score by evaluation type;
38. Number of evaluations by self-assessment score by evaluation group;
39. Number of evaluations by self-assessment score by school centre;
40. Number of evaluations by self-assessment score by category;
41. 5 years comparison of average of overall self-assessment score;
42. 5 years comparison of average of overall self-assessment score by evaluation type;
43. 5 years comparison of average of overall self-assessment score by evaluation group;
44. 5 years comparison of average of overall self-assessment score by school centre;
45. 5 years comparison of average of overall self-assessment score by category;
46. 5 years comparison of average of self-assessment score by evaluation type by school centre;
47. 5 years comparison of average of self-assessment score by evaluation type by category;
48. 5 years comparison of average of self-assessment score by evaluation group by school centre;
49. 5 years comparison of average of self-assessment score by evaluation group by category;
50. 5 years comparison of average of self-assessment score by school centre by category;
51. 5 years comparison of average of overall evaluation score;
52. 5 years comparison of average of overall evaluation score by evaluation type;
53. 5 years comparison of average of overall evaluation score by evaluation group;
54. 5 years comparison of average of overall evaluation score by school centre;
55. 5 years comparison of average of overall evaluation score by category;
56. 5 years comparison of average of evaluation score by evaluation type by school centre;
57. 5 years comparison of average of evaluation score by evaluation type by category;

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58. 5 years comparison of average of evaluation score by evaluation group by school centre;
59. 5 years comparison of average of evaluation score by evaluation group by category;
60. 5 years comparison of average of evaluation score by school centre by category;
61. 5 years comparison of average of overall discrepancy;
62. 5 years comparison of average of overall discrepancy by evaluation type;
63. 5 years comparison of average of overall discrepancy by evaluation group;
64. 5 years comparison of average of overall discrepancy by school centre;
65. 5 years comparison of average of overall discrepancy by category;
66. 5 years comparison of average of discrepancy by evaluation type by school centre;
67. 5 years comparison of average of discrepancy by evaluation type by category;
68. 5 years comparison of average of discrepancy by evaluation group by school centre;
69. 5 years comparison of average of discrepancy by evaluation group by category;
70. 5 years comparison of average of discrepancy by school centre by category;
71. 5 years comparison of number of evaluations by final score
72. 5 years comparison of number of evaluations by final score by evaluation type;
73. 5 years comparison of number of evaluations by final score by evaluation group;
74. 5 years comparison of number of evaluations by final score by school centre;
75. 5 years comparison of number of evaluations by final score by category;
76. 5 years comparison of number of evaluations by self-assessment score;
77. 5 years comparison of number of evaluations by self-assessment score by evaluation type;
78. 5 years comparison of number of evaluations by self-assessment score by evaluation group;
79. 5 years comparison of number of evaluations by self-assessment score by school centre;
80. 5 years comparison of number of evaluations by self-assessment score by category.

Appendix C – Use Cases Description

In this appendix, all use cases are detailed in a structured description.

Logs In

Precondition

No preconditions necessary.

Description

1. The user opens the IS;
2. The system shows screen with two text boxes regarding “Username” and “Password” and a “Log In” button;
3. The user selects fills its correct username and password and clicks the “Log In” button;
4. The system validates the filled credentials and, if they are valid, gives access to the correspondent user’s options.

Logs Out

Precondition

The user must be logged in the system.

Description

1. The user clicks the “Log Out” button located in the bottom right corner of the IS;
2. The system logs the user out, removing the access to any options of its user, until he logs in again.

Does Self-Assessment

Precondition

The user must be logged in the system with a main user.

Description

1. The user clicks the “Self-Assessment” button;
2. If the user has already performed the Self-Assessment for the current school year the system shows a message indicating that, if not, the system shows a screen with the instructions to perform the self-assessment;

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3. The user clicks the “Next” button;
4. The system shows the first group of questions as well as the possible scores for each question;
5. The user selects the score for each question and clicks “Next”;
6. Steps 4 and 5 are repeated for all groups of questions, with the option for the user to click “Back” to see/change the previous questions’ scores;
7. The system shows a page with a text box for the self-assessment comments;
8. The user fills the self-assessment comments and clicks “Submit”;
9. The system calculates the final score, stores all the self-assessment scores and its date in the database, and shows a success message to the user.

Evaluates Professional

Precondition

The user must be logged in the system with a main user which is associated to a professional that is evaluator in the current school year.

Description

1. The user clicks the “Evaluate” button;
2. The system shows a list of all professionals associated to the current school year and the statuses of their evaluations;
3. The user chooses a professional that had already performed its self-assessment but that hasn’t been yet evaluated, and clicks “Evaluate”;
4. The system shows a screen with the instructions to perform the evaluation;
5. The user clicks the “Next” button;
6. The system shows the first group of questions, the self-assessment scores and the possible scores for each question to be evaluated;
7. The user selects the score for each question and clicks “Next”;
8. Steps 4 and 5 are repeated for all groups of questions, with the option for the user to click “Back” to see/change the previous questions’ scores;
9. The system shows a page with a text box containing the self-assessment comments and a second text box for the evaluation comments;

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10. The user fills the evaluation comments and clicks “Submit”;
11. The system calculates the final score, stores all the evaluation scores and its date in the database, and shows a success message to the user;
12. After the user closes the shown message, the system goes back to the list of professionals with the evaluations statuses updated.

Views Evaluation

Precondition

The user must be logged in the system with an administrator user.

Description

1. The user clicks the “View” button;
2. The system shows a list of every evaluation that has been started or completed;
3. The user selects the desired evaluation;
4. The system shows all the details of the selected evaluation.

Views List of Missing Evaluations

Precondition

The user must be logged in the system with an administrator user.

Description

1. The user clicks the “Missing” button;
2. The system shows a list of all evaluations that have not been started or only have been self-assessed for the current school year;
3. The user may select a different school year in the shown *combo box* for that purpose and click “Recalculate”;
4. The system updates the list of missing evaluations to the chosen school year.

Generates Evaluation Reports

Precondition

The user must be logged in the system with an administrator user.

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Description

1. The user clicks the “Generate” button;
2. The system shows a screen with multiple options for the user to choose: school year, report, value, 1st and 2nd dimension;
3. The user selects the desired options and clicks “Generate”;
4. The system generates the desired report in an Excel file and shows a message indicating where the report was saved.

Adds / Updates /Deletes Data

Precondition

The user must be logged in the system with an administrator user.

Description

1. The user clicks the button correspondent to the data it wants to add / update / delete (school years, class rooms, categories, professionals, questions or weight – this last one can only be updated);
2. The system shows a list of the selected data and three buttons: one to add, another to update and the last one to delete. For school years there is also a button “Set as current” and for professionals a button “Manage Class Rooms”;
3. The user selects the desired instance in the list and clicks the button with the correspondent action (for the action “Add”, there is no need to select an instance in the list):
 - a. Add:
 - i. The system shows a new screen with all necessary options for introducing the necessary information to create the new correspondent entity;
 - ii. The user fills the necessary information and clicks “Add”;
 - iii. The system inserts the new instance in the database and shows a success

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message to the user⁴.

- b. Update:
 - i. The system shows a new screen with all the data editable regarding the selected instance;
 - ii. The user updates the information and clicks “Add”;
 - iii. The system updates the instance in the database and shows a success message to the user⁵.
- c. Delete:
 - i. The system asks the user to confirm if he wants to delete the selected instance;
 - ii. If the user confirms the action, the system deletes the instance from the database and shows a success message to the user⁶.
- d. Set as Current (School Years):
 - i. The system asks the user to confirm if he wants to change the current school year to the one selected;
 - ii. If the user confirms the action, the system sets the current school year as not current, updates the selected one to current and shows a success message to the user.
- e. Manage Class Rooms (Professionals):
 - i. The system shows a new screen with a list of assigned class rooms to the selected professional and correspondent school year, category and school centre. Also, four *combo boxes* are shown with the options to choose school year, category, school centre and class room, as well as the buttons “Assign” and “Remove”;
 - ii. The user can then assign or remove a class room to the previously

⁴ The system has unique constraints for all fields that should uniquely identify an instance in the users' perspective (fields like “Name” and “Description”). When a user tries to insert a new instance with an already existing value, it cancels the action and shows an error message to the user.

⁵ The system has foreign keys implemented with the cascade option for all update actions.

⁶ The system has foreign keys implemented that only allow the deletion of instances that are not associated with other instances in other tables.

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selected professional:

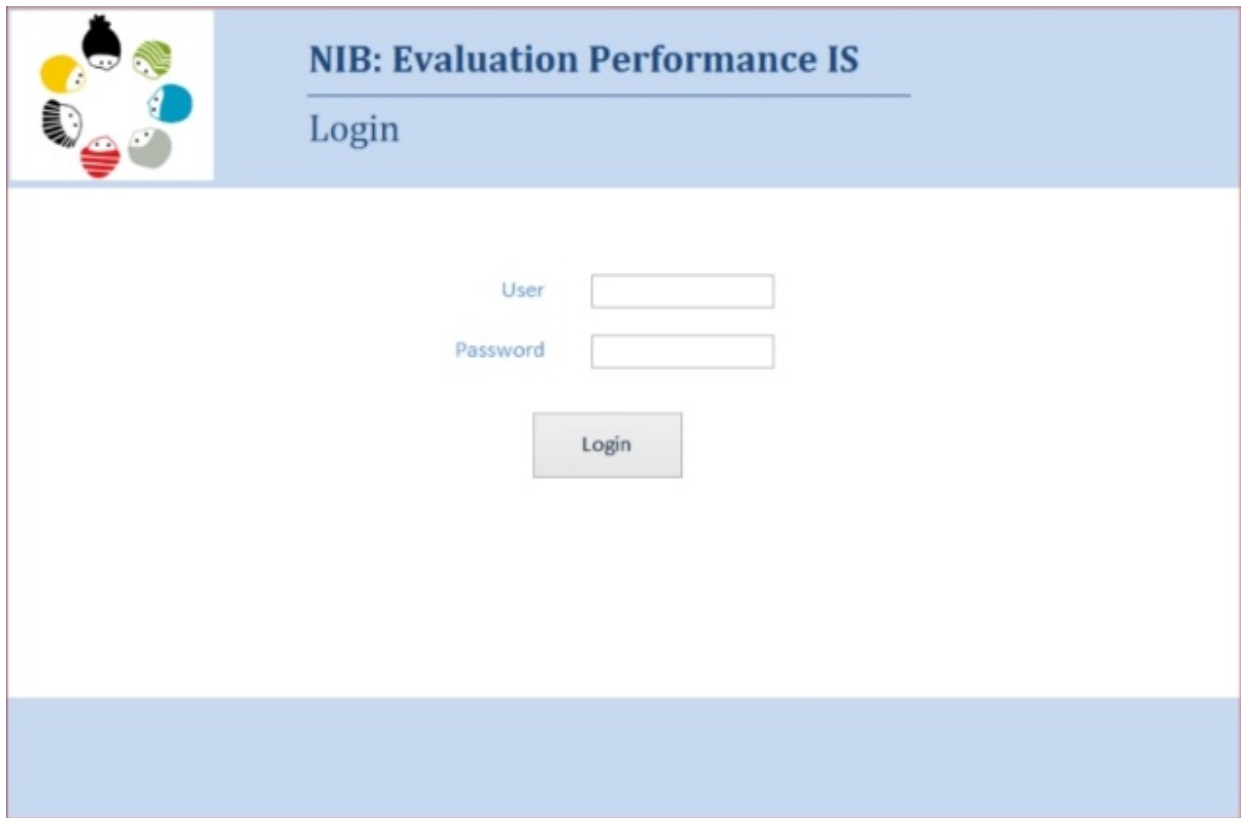
1. Assign:

- a. The user selects the desired options for school year, category, school centre and class room, and clicks “Assign”;
- b. The system asks the user to confirm if he wants to assign the selected class room and remaining data to the professional;
- c. If the user confirms the action, the system adds the association in the database and shows a success message to the user.

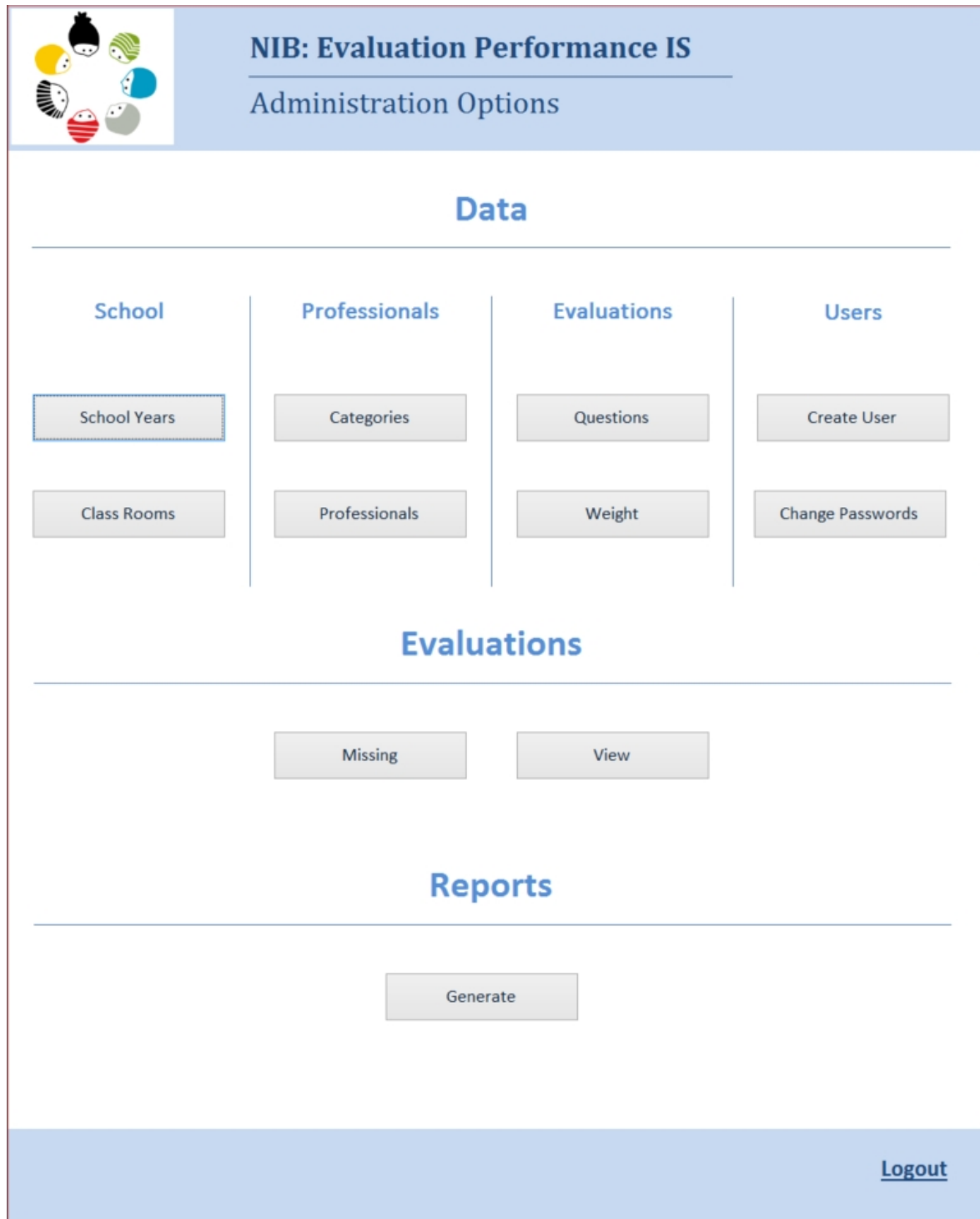
2. Remove:

- a. The user selects the desired class room in the list and clicks “Remove”;
- b. The system asks the user to confirm if he wants to remove the professional’s association with the selected class room;
- c. If the user confirms the action, the system deletes the association in the database and shows a success message to the user.

Appendix D – Implemented User Interfaces



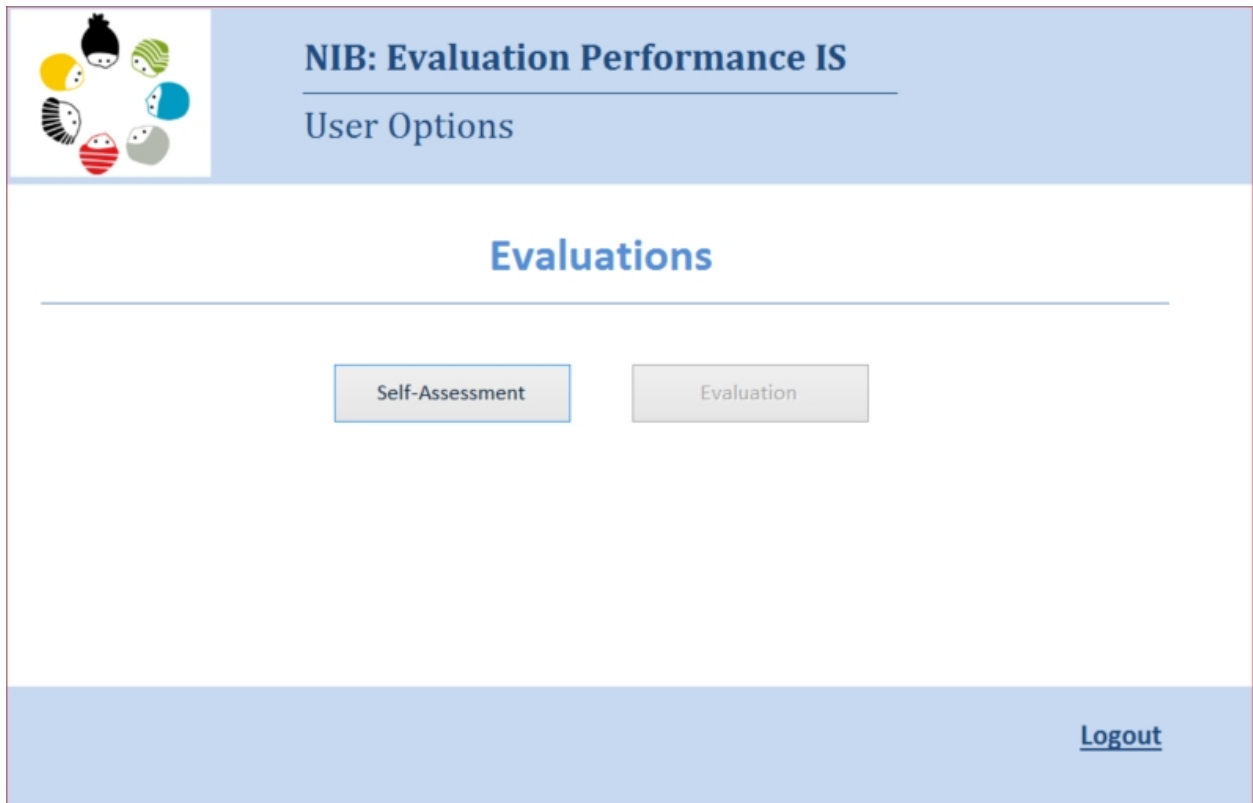
User Interface 1 – Login



The image shows a web application interface for "NIB: Evaluation Performance IS". The interface is divided into several sections: "Data", "Evaluations", and "Reports".

- Header:** The top left features a logo with colorful cartoon faces. The top right contains the title "NIB: Evaluation Performance IS" and the subtitle "Administration Options".
- Data Section:** This section is divided into four columns: "School", "Professionals", "Evaluations", and "Users".
 - School:** Contains buttons for "School Years" (highlighted with a blue border) and "Class Rooms".
 - Professionals:** Contains buttons for "Categories" and "Professionals".
 - Evaluations:** Contains buttons for "Questions" and "Weight".
 - Users:** Contains buttons for "Create User" and "Change Passwords".
- Evaluations Section:** Contains two buttons: "Missing" and "View".
- Reports Section:** Contains one button: "Generate".
- Footer:** A blue bar at the bottom right contains a "Logout" link.


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User Interface 3 – User Options (Not Evaluator)



User Interface 4 – User Options (Evaluator)



NIB: Evaluation Performance IS
Self-Assessment: Instructions

Instructions

Please fill the next forms with your self-assessment.

For Transversal and Specific questions you can choose the following options:
1 - Never 2 - A few times 3 - Sometimes 4 - Many times 5 - Always

For Goals questions you can choose if you have met the goal or not.

To continue please click Next.

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User Interface 5 – Self-Assessment: Instructions



NIB: Evaluation Performance IS

Self-Assessment: Transversal


Professional Autonomy

2015/2016: Mary Robinson

Score	Questions
<input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Perform your tasks aiming for the highest quality, always taking into account the proposed result and meeting the defined deadlines
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Follow the procedures defined by the institution using the appropriate tools and forms
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Keep your direct supervisor informed of the progress of your work, alerting him in time to any factors that may require his intervention
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Be careful with the Institution's assets, using them correctly and being careful with their equipment's conservation
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Be assiduous (5 – skip work less than 3 times, 4 – from 4 to 7 times, 3 – from 8 to 11 times, 2 – from 12 to 15 times, 1 – more than 5 times)
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Be on time (5 – be late to work less than 3 times, 4 – from 4 to 7 times, 3 – from 8 to 11 times, 2 – from 12 to 15 times, 1 – more than 5 times)

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User Interface 6 – Self-Assessment: Transversal – Professional Autonomy



NIB: Evaluation Performance IS
Self-Assessment: Transversal

Interpersonal Relationship

2015/2016: Mary Robinson

Score	Questions
<input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Share information and work well as a team
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Establish a good relationship and collaborate with other colleagues not only in your area but also in other sectors

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User Interface 7 – Self-Assessment: Transversal – Interpersonal Relationship



NIB: Evaluation Performance IS

Self-Assessment: Transversal

Communication

2015/2016: Mary Robinson

Score	Questions
<input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Establish a good relationship with the children's families, always trying to respond appropriately
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Communicate clearly by adjusting your language to the counterparts
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Be able to listen
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Be able to question
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Having self-control in situations of confrontation

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User Interface 8 – Self-Assessment: Transversal – Communication



NIB: Evaluation Performance IS
Self-Assessment: Transversal


Personal Development

2015/2016: Mary Robinson

Score	Questions
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Show interest in attending training courses
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Show good learning abilities and being able to apply the knowledge acquired in both courses and on job

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User Interface 9 – Self-Assessment: Transversal – Personal Development

		NIB: Evaluation Performance IS Self-Assessment: Transversal	
Discipline and Work Commitment			
2015/2016: Mary Robinson			
Score		Questions	
<input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5		Understand and guide your work taking into account the Vision, Mission, Values and Quality Policy of the Institution	
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5		Understand the importance of your role in the area in which you work	
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5		Face all proposed challenges with a positive attitude	
Back --- Next		Logout	

User Interface 10 – Self-Assessment: Transversal – Discipline and Work Commitment

		NIB: Evaluation Performance IS Self-Assessment: Transversal	
Change and Innovation			
2015/2016: Mary Robinson			
Score		Questions	
<input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5		Show ability to solve problems: identify problems, analyze and propose solutions	
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5		Show dynamism in new or routine situations, presenting new ideas and alternative solutions	
Back --- Next		Logout	

User Interface 11 – Self-Assessment: Transversal – Change and Innovation



NIB: Evaluation Performance IS

Self-Assessment: Specific

Specific

2015/2016: Mary Robinson

Score	Questions
<input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Plan the socio-educational action by elaborating an annual project that takes into account the theme of the educational equipment and the learning goals for the kindergarten
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Manage and integrate the available human and material resources
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Promote child development and ensure that all children reach the learning goals set for their age
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Observe, assess and record the children development
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Identify and direct children with educational needs by drawing up an Individual Plan that reflects the difficulties and educational proposals to overcome those needs
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Organize and keep up-to-date (in a confidential manner) the individual process of each child, according to internal procedures
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Promote meetings with parents and other educational partners
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Report all information pertaining to the education of the child to its parents and/or guardians
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Take part in festivities and other significant dates
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	Participate in other pedagogical actions when requested

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User Interface 12 – Self-Assessment: Specific



NIB: Evaluation Performance IS

Self-Assessment: Goals

Goals

2015/2016: Mary Robinson

Score	Questions
<input type="radio"/> Met <input type="radio"/> Not met	Every six months, send / submit to the pedagogical director, the monthly plans in digital format
<input type="radio"/> Met <input type="radio"/> Not met	At the end of January and at the end of June, send / submit to the pedagogical director, the observation / evaluation sheets in digital format
<input type="radio"/> Met <input type="radio"/> Not met	Send / submit to the pedagogical director, the evaluation of the school year until July 15th
<input type="radio"/> Met <input type="radio"/> Not met	Participate in (at least) one training action on topics related to pedagogical practice
<input type="radio"/> Met <input type="radio"/> Not met	Work collaboratively and cooperatively among teachers in two annual projects

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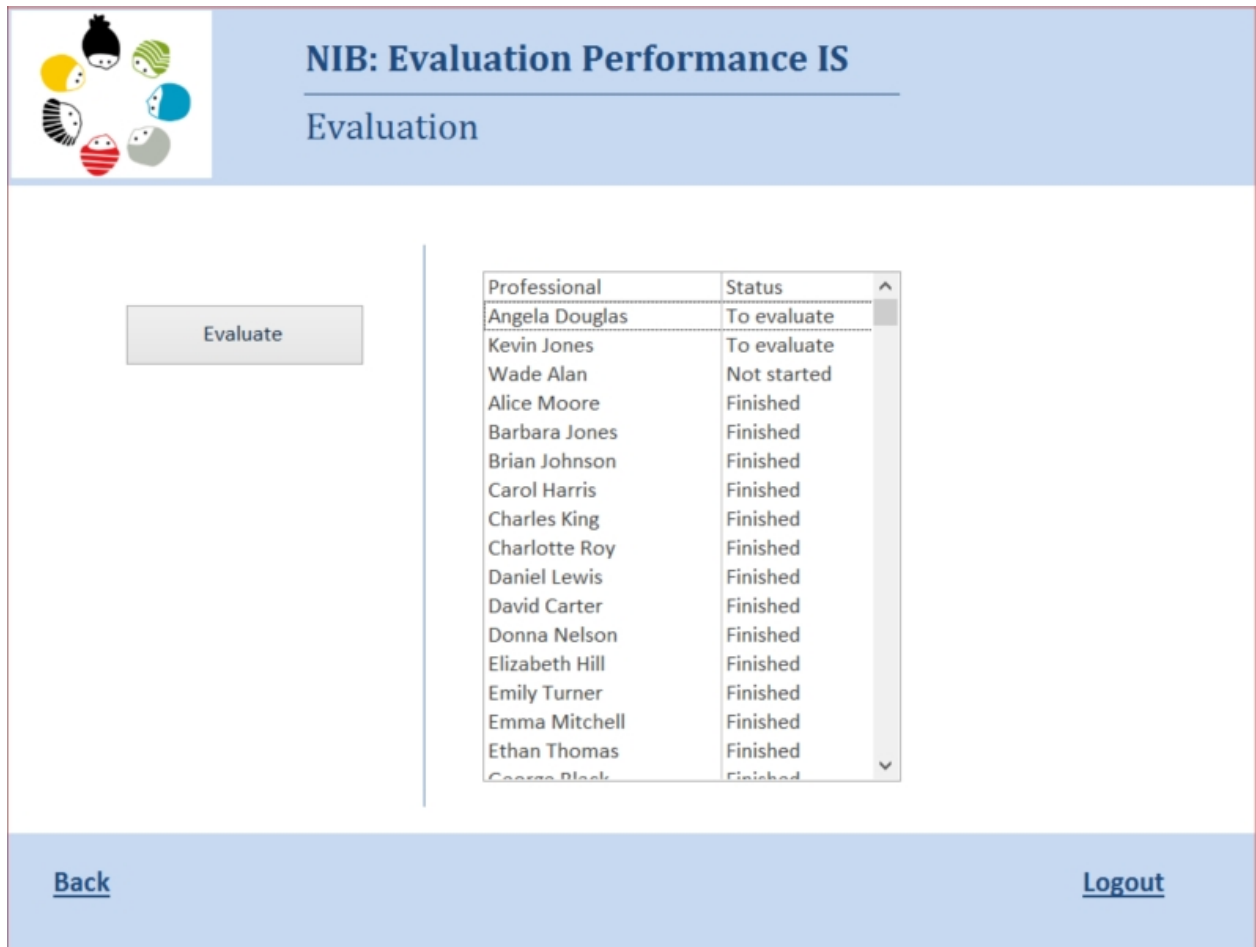
User Interface 13 – Self-Assessment: Goals



The image shows a web interface for a preschool performance evaluation system. At the top left is a logo with six colorful cartoon faces. The top header is light blue and contains the text "NIB: Evaluation Performance IS" and "Self-Assessment: Submit". Below this is a white section with the heading "Comments" and a horizontal line. Under the line, it says "2015/2016: Mary Robinson". In the center is a large empty rectangular box for entering comments. Below the box is a "Submit" button. At the bottom of the interface is a light blue footer with a "Back" link on the left and a "Logout" link on the right.

User Interface 14 – Self-Assessment: Submit


IS to Manage the Evaluation of Employees' Performance in a Preschool



The screenshot shows a web application interface for 'NIB: Evaluation Performance IS'. The header includes a logo with colorful faces and the title 'NIB: Evaluation Performance IS' followed by 'Evaluation'. A central 'Evaluate' button is on the left. A table on the right lists professionals and their evaluation status. At the bottom, there are 'Back' and 'Logout' links.

Professional	Status
Angela Douglas	To evaluate
Kevin Jones	To evaluate
Wade Alan	Not started
Alice Moore	Finished
Barbara Jones	Finished
Brian Johnson	Finished
Carol Harris	Finished
Charles King	Finished
Charlotte Roy	Finished
Daniel Lewis	Finished
David Carter	Finished
Donna Nelson	Finished
Elizabeth Hill	Finished
Emily Turner	Finished
Emma Mitchell	Finished
Ethan Thomas	Finished
George Black	Finished

User Interface 15 – Evaluation: Evaluate



NIB: Evaluation Performance IS
Evaluation: Instructions

Instructions

Please fill the next forms with your evaluation.

For Transversal and Specific questions you can choose the following options:
1 - Never 2 - A few times 3 - Sometimes 4 - Many times 5 - Always

For Goals questions you can choose if you have met the goal or not.

To continue please click Next.

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User Interface 16 – Evaluation: Instructions



NIB: Evaluation Performance IS

Evaluation: Transversal


Professional Autonomy

2015/2016: Angela Douglas

Score	SA	Questions
<input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	3	Perform your tasks aiming for the highest quality, always taking into account the proposed result and meeting the defined deadlines
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	5	Follow the procedures defined by the institution using the appropriate tools and forms
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	5	Keep your direct supervisor informed of the progress of your work, alerting him in time to any factors that may require his intervention
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	3	Be careful with the Institution's assets, using them correctly and being careful with their equipment's conservation
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	2	Be assiduous (5 – skip work less than 3 times, 4 – from 4 to 7 times, 3 – from 8 to 11 times, 2 – from 12 to 15 times, 1 – more than 5 times)
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	3	Be on time (5 – be late to work less than 3 times, 4 – from 4 to 7 times, 3 – from 8 to 11 times, 2 – from 12 to 15 times, 1 – more than 5 times)

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User Interface 17 – Evaluation: Transversal – Professional Autonomy



NIB: Evaluation Performance IS
Evaluation: Transversal

Interpersonal Relationship

2015/2016: Angela Douglas

Score	SA	Questions
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	5	Share information and work well as a team
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	1	Establish a good relationship and collaborate with other colleagues not only in your area but also in other sectors

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User Interface 18 – Evaluation: Transversal – Interpersonal Relationship



NIB: Evaluation Performance IS
Evaluation: Transversal


Communication

2015/2016: Angela Douglas

Score	SA	Questions
<input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	3	Establish a good relationship with the children's families, always trying to respond appropriately
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	4	Communicate clearly by adjusting your language to the counterparts
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	2	Be able to listen
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	5	Be able to question
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	1	Having self-control in situations of confrontation

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User Interface 19 – Evaluation: Transversal – Communication



NIB: Evaluation Performance IS
Evaluation: Transversal


Personal Development

2015/2016: Angela Douglas

Score	SA	Questions
<input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	1	Show interest in attending training courses
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	3	Show good learning abilities and being able to apply the knowledge acquired in both courses and on job

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User Interface 20 – Evaluation: Transversal – Personal Development



NIB: Evaluation Performance IS
Evaluation: Transversal


Discipline and Work Commitment

2015/2016: Angela Douglas

Score	SA	Questions
<input type="radio"/> 1 <input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	2	Understand and guide your work taking into account the Vision, Mission, Values and Quality Policy of the Institution
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	5	Understand the importance of your role in the area in which you work
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	4	Face all proposed challenges with a positive attitude

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User Interface 21 – Evaluation: Transversal – Discipline and Work Commitment



NIB: Evaluation Performance IS
Evaluation: Transversal

Change and Innovation

2015/2016: Angela Douglas

Score	SA	Questions
<input type="radio"/> 1 <input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	1	Show ability to solve problems: identify problems, analyze and propose solutions
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	1	Show dynamism in new or routine situations, presenting new ideas and alternative solutions

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User Interface 22 – Evaluation: Transversal – Change and Innovation



NIB: Evaluation Performance IS

Evaluation: Specific

Specific

2015/2016: Angela Douglas

Score	SA	Questions
<input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	4	Perform your tasks aiming for the highest quality, always taking into account the proposed result and meeting the defined deadlines
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	3	Manage and integrate the available human and material resources
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	3	Promote child development and ensure that all children reach the learning goals set for their age
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	3	Observe, assess and record the children development
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	1	Identify and direct children with educational needs by drawing up an Individual Plan that reflects the difficulties and educational proposals to overcome those needs
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	1	Organize and keep up-to-date (in a confidential manner) the individual process of each child, according to internal procedures
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	5	Promote meetings with parents and other educational partners
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	4	Report all information pertaining to the education of the child to its parents and/or guardians
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	4	Take part in festivities and other significant dates
<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5	2	Participate in other pedagogical actions when requested

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User Interface 23 – Evaluation: Specific

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS

Evaluation: Goals

Goals

2015/2016: Angela Douglas

Score	SA	Questions
<input checked="" type="radio"/> Met <input type="radio"/> Not met	Met	Every six months, send / submit to the pedagogical director, the monthly plans in digital format
<input type="radio"/> Met <input type="radio"/> Not met	Not Met	At the end of January and at the end of June, send / submit to the pedagogical director, the observation / evaluation sheets in digital format
<input type="radio"/> Met <input type="radio"/> Not met	Met	Send / submit to the pedagogical director, the evaluation of the school year until July 15th
<input type="radio"/> Met <input type="radio"/> Not met	Met	Participate in (at least) one training action on topics related to pedagogical practice
<input type="radio"/> Met <input type="radio"/> Not met	Not Met	Work collaboratively and cooperatively among teachers in two annual projects

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User Interface 24 – Evaluation: Goals



The image shows a web interface for 'NIB: Evaluation Performance IS'. At the top left is a logo with colorful cartoon faces. The main header is blue and contains the text 'NIB: Evaluation Performance IS' and 'Evaluation: Submit'. Below this is a section titled 'Comments' for the '2015/2016: Angela Douglas' evaluation. There are two text input areas: 'Evaluated's Comments' (containing the text 'Comments from the evaluated.') and 'Evaluator's Comments'. A 'Submit' button is centered below these fields. At the bottom of the interface are two links: 'Back' on the left and 'Logout' on the right.

User Interface 25 – Evaluation: Submit

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS

Data: School - School Years

Add

Update

Delete


Set as Current

School Year	Current Year	# Professionals
2015/2016	Yes	42
2016/2017		0

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User Interface 26 – Data: School Years

IS to Manage the Evaluation of Employees' Performance in a Preschool



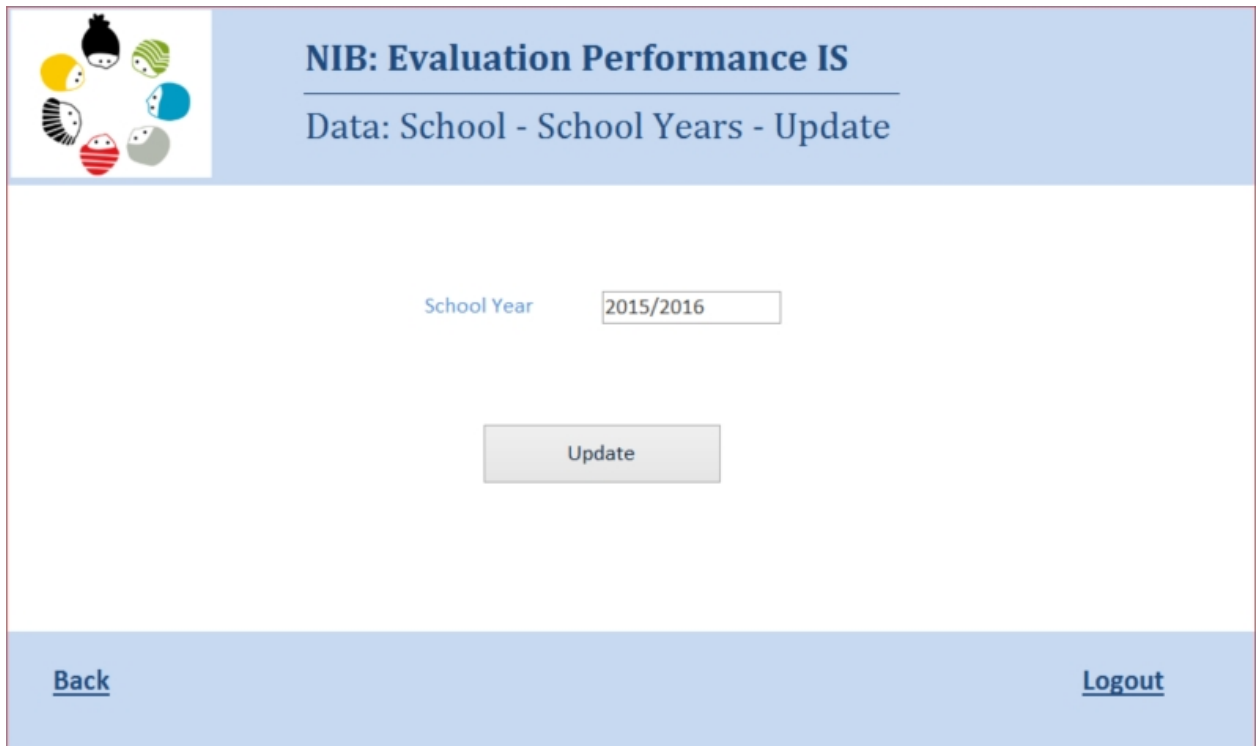
NIB: Evaluation Performance IS
Data: School - School Years - Add

School Year

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User Interface 27 – Data: School Years – Add

IS to Manage the Evaluation of Employees' Performance in a Preschool



The image shows a web application interface for updating school years. At the top left, there is a logo consisting of six stylized faces in a circle. The main header area is light blue and contains the text "NIB: Evaluation Performance IS" and "Data: School - School Years - Update". Below this, there is a form with a label "School Year" and a text input field containing "2015/2016". A grey "Update" button is positioned below the input field. At the bottom of the interface, there are two links: "Back" on the left and "Logout" on the right, both underlined.

NIB: Evaluation Performance IS
Data: School - School Years - Update


School Year

Update

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User Interface 28 – Data: School Years – Update

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS

Data: School - Class Rooms

Add

Update


Delete

School Centre	Class Room
General	General
Kindergarten	Kindergarten Class 1
Kindergarten	Kindergarten Class 2
Nursery	Nursery Class

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User Interface 29 – Data: Class Rooms

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS
Data: School - Class Rooms - Add


School Centre

Class Room

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User Interface 30 – Data: Class Rooms – Add

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS
Data: School - Class Rooms - Update


School Centre

Class Room

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User Interface 31 – Data: Class Rooms – Update

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS Data: Professionals - Categories

Add

Update

Delete


Category	Evaluator
Accounting	
Assistant Educator	
Cook	
Doorman	
Educator	
Financial Director	Yes
General Services	
Gym Teacher	
Human Resources	
Kitchen Helper	
Music Teacher	
Pedagogical Director	Yes
Treasury	

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User Interface 32 – Data: Categories

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS
Data: Professionals - Categories - Add


Category

Evaluator

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User Interface 33 – Data: Categories – Add

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS

Data: Professionals - Categories - Update

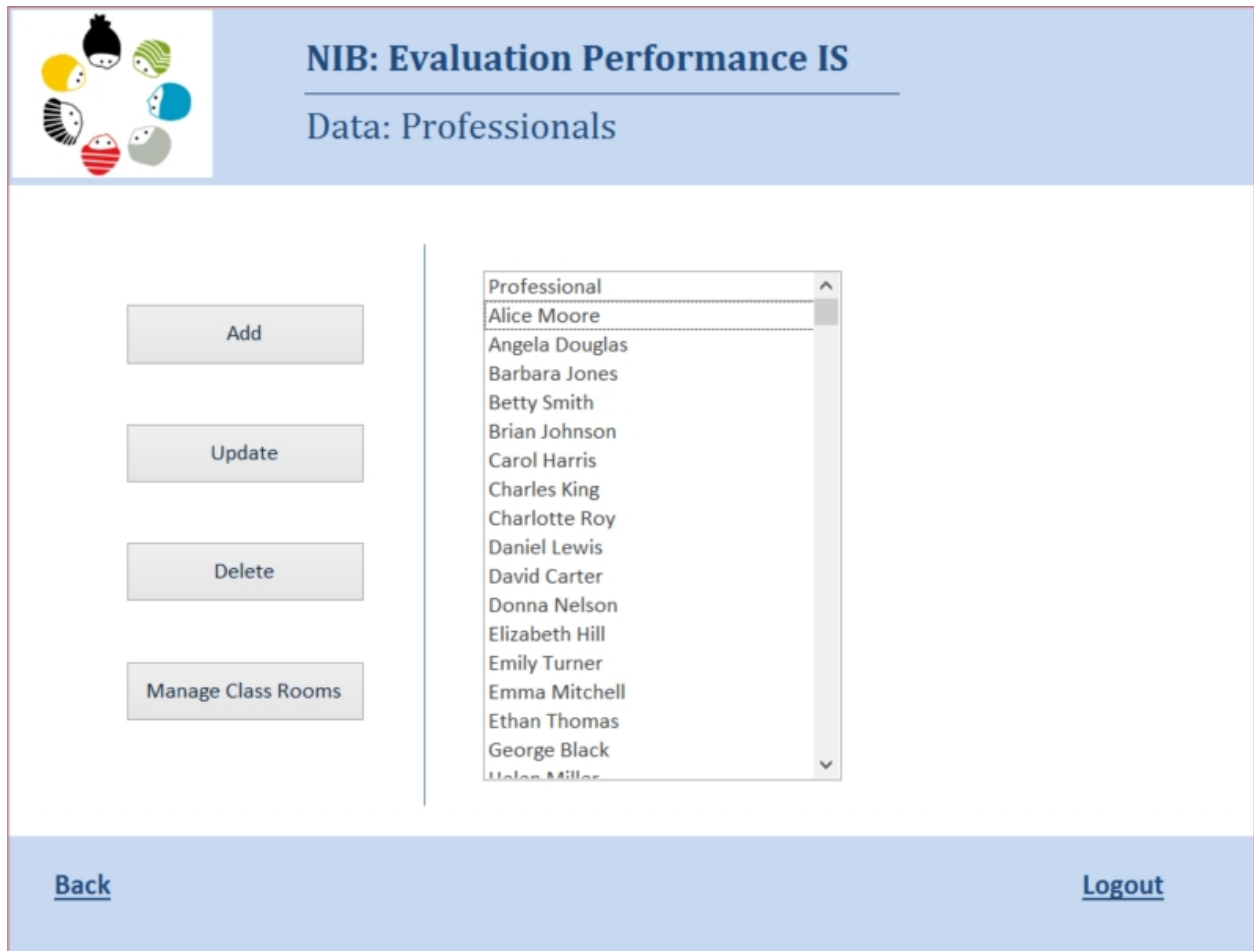
Category

Evaluator

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User Interface 34 – Data: Categories – Update

IS to Manage the Evaluation of Employees' Performance in a Preschool



User Interface 35 – Data: Professionals

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS
Data: Professionals - Add

Name

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User Interface 36 – Data: Professionals – Add


IS to Manage the Evaluation of Employees' Performance in a Preschool



The image shows a web application interface for updating professional data. At the top left, there is a logo consisting of six stylized, colorful faces arranged in a circle. To the right of the logo, the page title "NIB: Evaluation Performance IS" is displayed in a bold, dark blue font, followed by the subtitle "Data: Professionals - Update" in a regular dark blue font. Below the title, there is a form with a label "Name" and a text input field containing the name "Alice Moore". Below the input field is a grey "Update" button. At the bottom of the interface, there are two blue buttons: "Back" on the left and "Logout" on the right.

User Interface 37 – Data: Professionals – Update

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS

Data: Professionals - Manage Class Rooms

School Year ▼

Category ▼

School Centre ▼


Class Room ▼

School Year	Category	School Centre	Class Room
2015/2016	Assistant Educator	Kindergarten	Kindergarten Class 1

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User Interface 38 – Data: Professionals – Manage Class Rooms

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS

Data: Evaluations - Questions

Add

Update

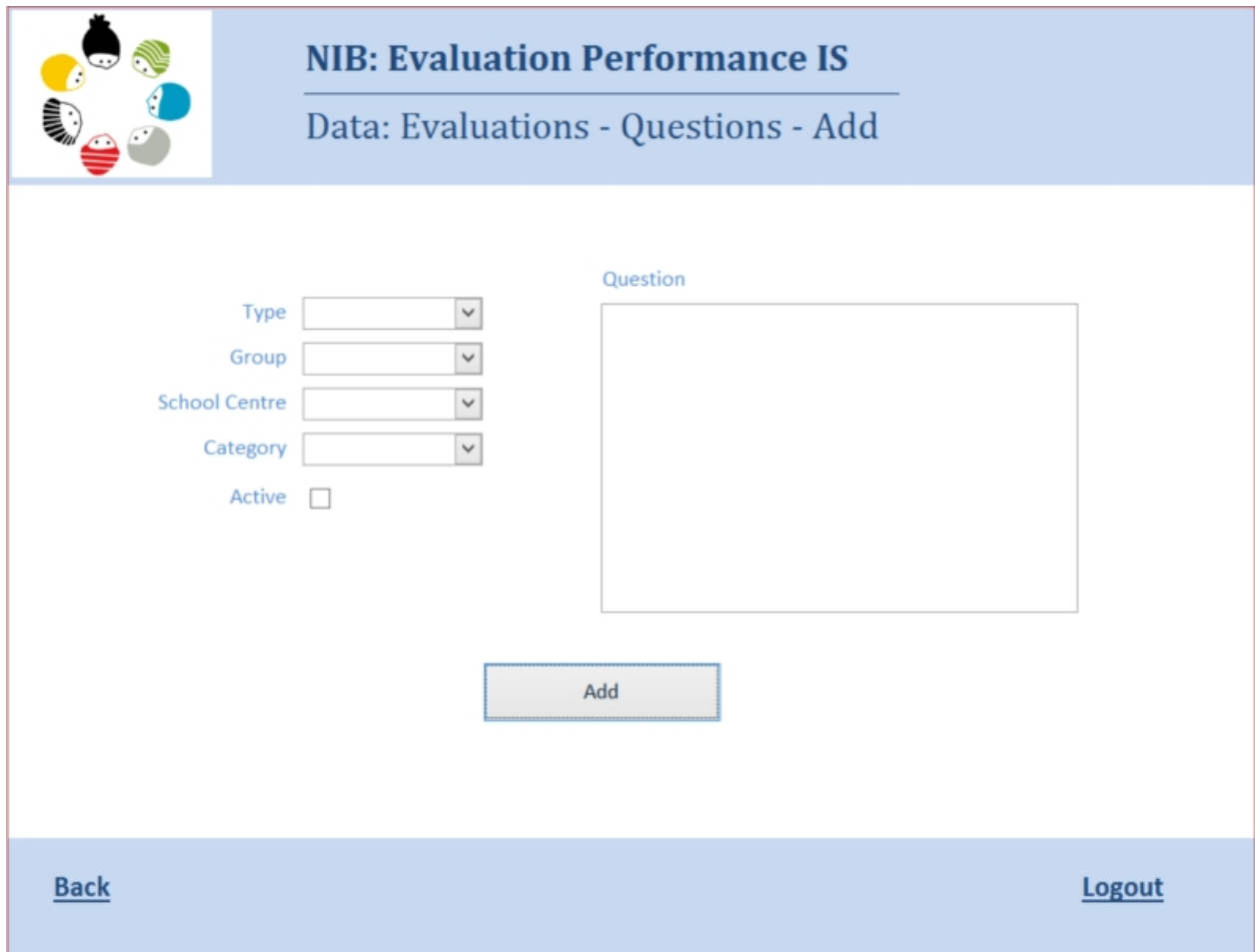
Delete

Type	Group	School Centre	Category	Active	Question
Transversal	Communication			Yes	Establish a good relationship with the children's families, always tryin
Transversal	Communication			Yes	Having self-control in situations of confrontation
Transversal	Personal Development			Yes	Show good learning abilities and being able to apply the knowledge a
Transversal	Personal Development			Yes	Show interest in attending training courses
Transversal	Discipline and Work Commitment			Yes	Face all proposed challenges with a positive attitude
Transversal	Discipline and Work Commitment			Yes	Understand and guide your work taking into account the Vision, Missi
Transversal	Discipline and Work Commitment			Yes	Understand the importance of your role in the area in which you wor
Transversal	Change and Innocation			Yes	Show ability to solve problems: identify problems, analyze and propo
Transversal	Change and Innocation			Yes	Show dynamism in new or routine situations, presenting new ideas ar
Specific	Specific	General	Accounting	Yes	Check current accounts, make bank reconciliations and issue balance
Specific	Specific	General	Accounting	Yes	Classify and post accounting documents, complying with the procedu
Specific	Specific	General	Accounting	Yes	Ensure customers' service in a cordial, welcoming and complying with
Specific	Specific	General	Accounting	Yes	Perform legal administrative tasks according to the existing deadlines
Specific	Specific	General	Accounting	Yes	Perform other administrative tasks when requested
Specific	Specific	General	Doorman	Yes	Go to the Food Bank weekly to get food
Specific	Specific	General	Doorman	Yes	Monitor the entrance and exit of the Institution, complying with the p
Specific	Specific	General	Doorman	Yes	Perform on-site repairs
Specific	Specific	General	Doorman	Yes	Perform other cleaning, maintenance and delivery tasks when reques
Specific	Specific	General	Doorman	Yes	Support the cleaning and irrigation tasks of outdoor spaces
Specific	Specific	General	Financial Director	Yes	Articulate the list of users with treasury and the pedagogical director,
Specific	Specific	General	Financial Director	Yes	Carry out accounts closure and annual budget operations
Specific	Specific	General	Financial Director	Yes	Conduct the management of non-teaching staff, promoting meetings
Specific	Specific	General	Financial Director	Yes	Mediate between staff and Administration, keeping them informed w
Specific	Specific	General	Financial Director	Yes	Monitor, coordinate and supervise all administrative processes (proce
Specific	Specific	General	Financial Director	Yes	Negotiate delivery agreements and as well as products and services r
Specific	Specific	General	Financial Director	Yes	Organize schedules, absences and vacations ensuring compliance with
Specific	Specific	General	Financial Director	Yes	Prepare training plans and disseminate training actions alongside the
Specific	Specific	General	Financial Director	Yes	Stipulate investment proposals, requesting the necessary budgets
Specific	Specific	General	Gym Teacher	Yes	Attend meetings when requested
Specific	Specific	General	Gym Teacher	Yes	Collaborate in other pedagogical actions, when requested
Specific	Specific	General	Gym Teacher	Yes	Manage and integrate the available resources
Specific	Specific	General	Gym Teacher	Yes	Plan the physical activity's educational action
Specific	Specific	General	Gym Teacher	Yes	Promote children's development
Specific	Specific	General	Gym Teacher	Yes	Take part in festivities and other significant dates

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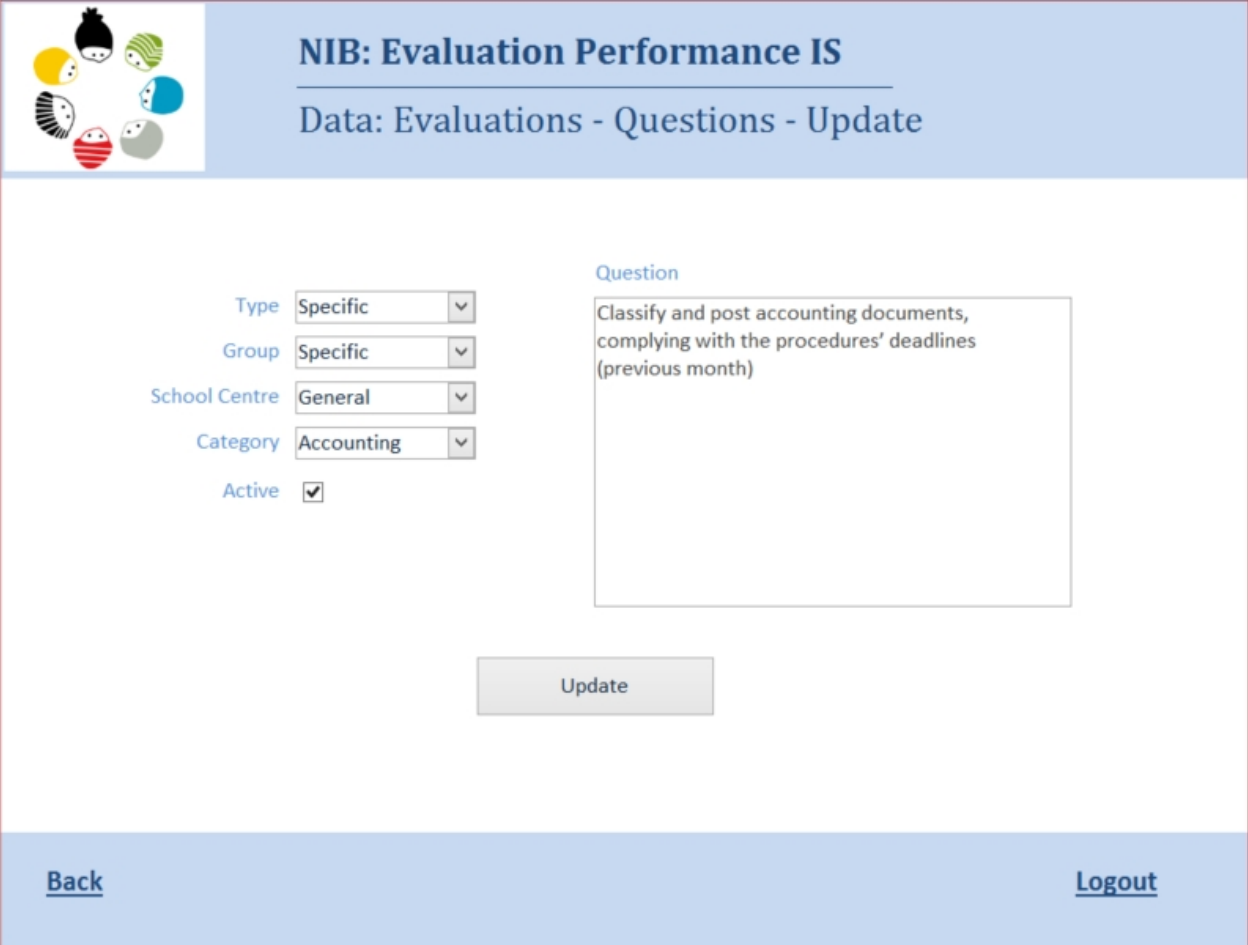
User Interface 39 – Data: Questions

IS to Manage the Evaluation of Employees' Performance in a Preschool



The image shows a web application interface for adding a new question. At the top left is a logo with six colorful cartoon faces. The header area is light blue and contains the text "NIB: Evaluation Performance IS" and "Data: Evaluations - Questions - Add". The main content area is white and contains several form fields: "Type", "Group", "School Centre", and "Category" are each followed by a dropdown menu; "Active" is followed by an unchecked checkbox. To the right of these fields is a large empty text area labeled "Question". Below the form fields is a grey "Add" button. At the bottom of the page, there is a light blue footer bar with the text "Back" on the left and "Logout" on the right.

User Interface 40 – Data: Questions – Add



The screenshot shows a web application interface for updating evaluation questions. At the top left is a logo with colorful cartoon faces. The header contains the text "NIB: Evaluation Performance IS" and "Data: Evaluations - Questions - Update". The main area features a form with several dropdown menus: "Type" (Specific), "Group" (Specific), "School Centre" (General), and "Category" (Accounting). There is also an "Active" checkbox which is checked. To the right, a text area labeled "Question" contains the text: "Classify and post accounting documents, complying with the procedures' deadlines (previous month)". Below the form is an "Update" button. At the bottom, there are "Back" and "Logout" links.

NIB: Evaluation Performance IS
Data: Evaluations - Questions - Update

Type:

Group:

School Centre:

Category:

Active:

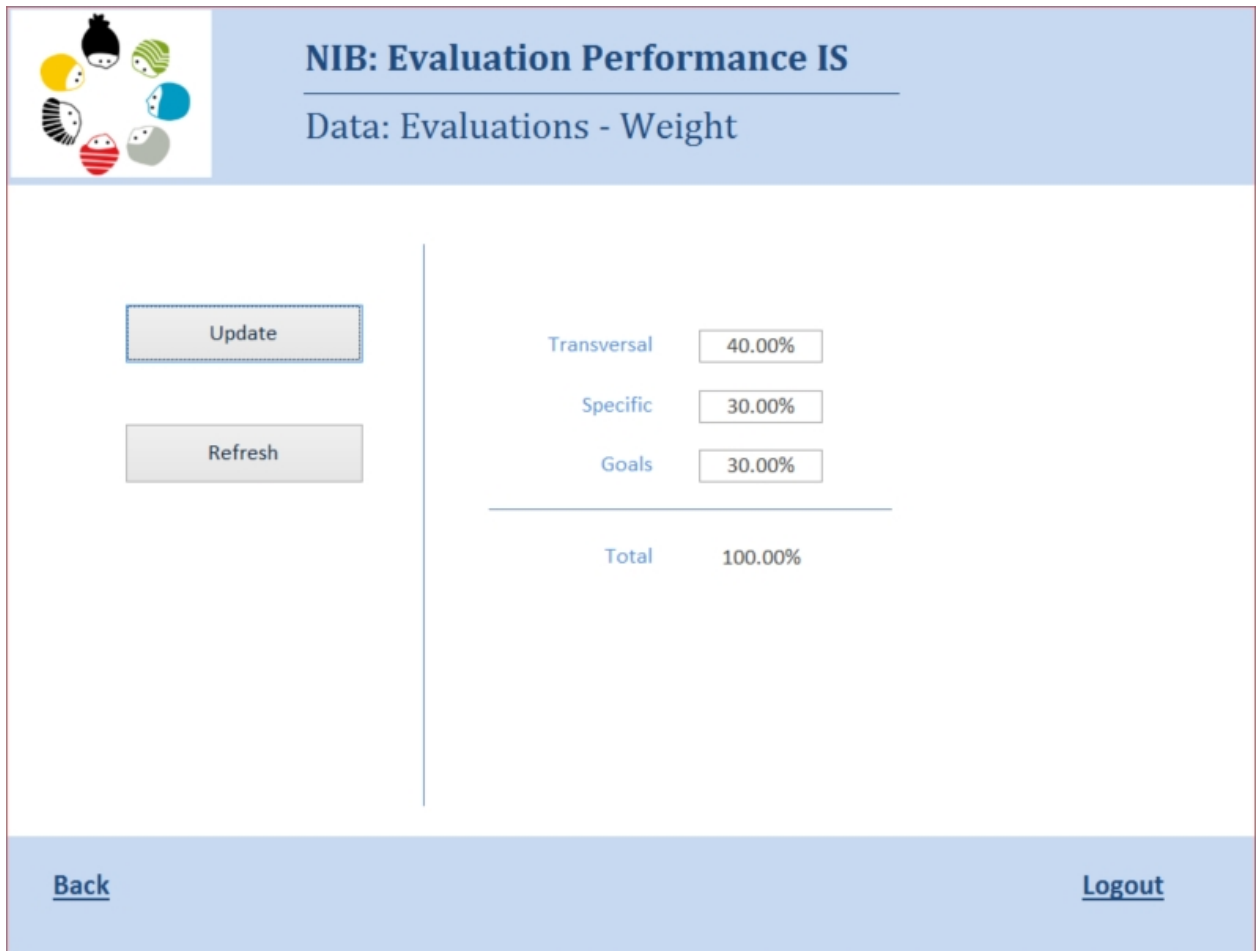
Question

Classify and post accounting documents, complying with the procedures' deadlines (previous month)

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User Interface 41 – Data: Questions – Update

IS to Manage the Evaluation of Employees' Performance in a Preschool

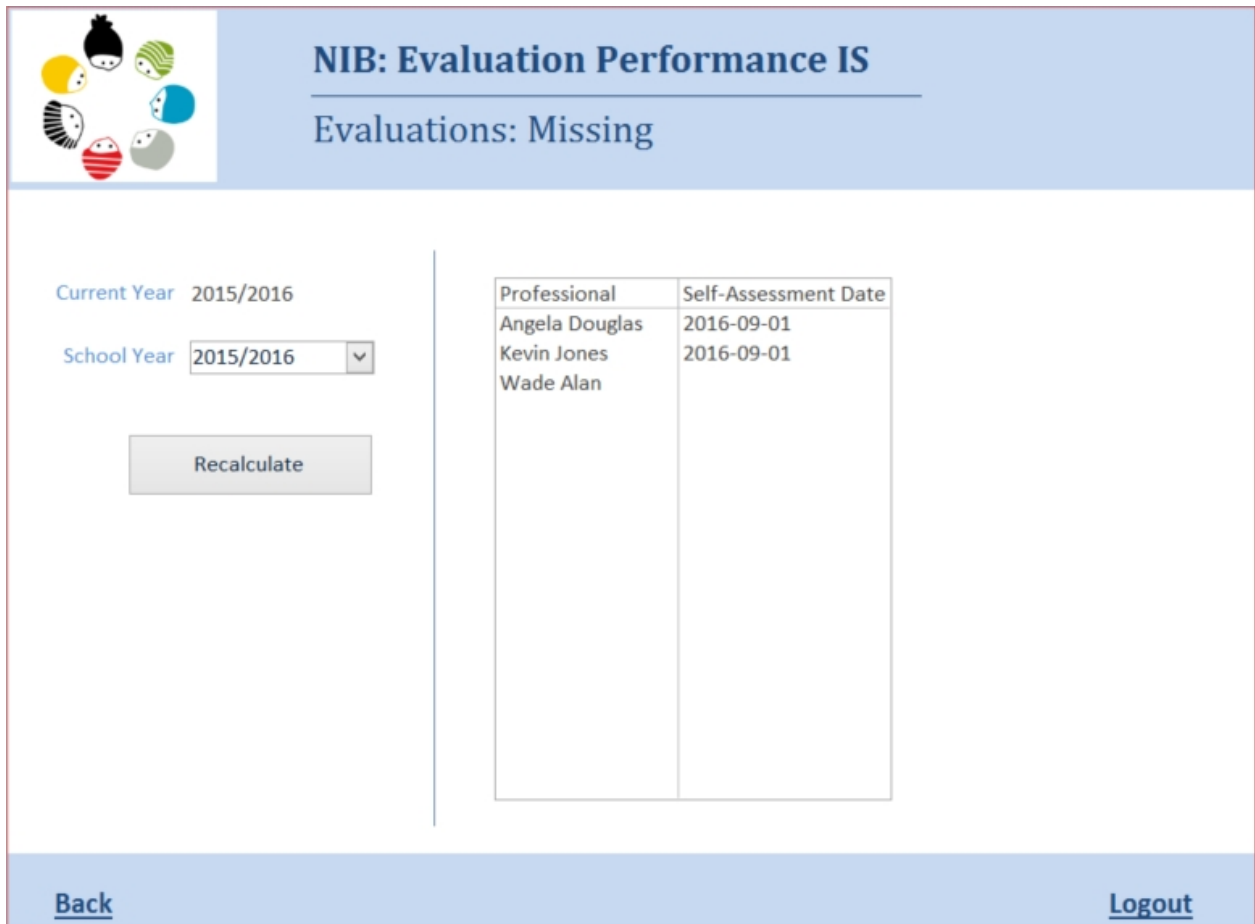


The interface displays a header with a logo of six stylized faces and the title "NIB: Evaluation Performance IS" and subtitle "Data: Evaluations - Weight". On the left, there are "Update" and "Refresh" buttons. On the right, a table shows the weight distribution: Transversal (40.00%), Specific (30.00%), and Goals (30.00%), with a total of 100.00%. The footer contains "Back" and "Logout" links.

Category	Weight
Transversal	40.00%
Specific	30.00%
Goals	30.00%
Total	100.00%

User Interface 42 – Data: Evaluations – Weight

IS to Manage the Evaluation of Employees' Performance in a Preschool




The interface features a header with a logo of six stylized faces and the title "NIB: Evaluation Performance IS" followed by "Evaluations: Missing". On the left, there are controls for "Current Year" (2015/2016) and "School Year" (2015/2016) with a dropdown arrow, and a "Recalculate" button. On the right, a table lists professionals and their self-assessment dates.

Professional	Self-Assessment Date
Angela Douglas	2016-09-01
Kevin Jones	2016-09-01
Wade Alan	

At the bottom, there are "Back" and "Logout" links.

User Interface 43 – Evaluations: Missing



NIB: Evaluation Performance IS

Evaluations: View

View


School Year	Evaluator	Evaluated	Score	
2015/2016	Mary Robinson	Alice Moore	3.34	^
2015/2016	Mary Robinson	Angela Douglas		
2015/2016	Mary Robinson	Barbara Jones	2.48	
2015/2016	Mary Robinson	Betty Smith	2.43	
2015/2016	Mary Robinson	Brian Johnson	2.15	
2015/2016	Mary Robinson	Carol Harris	3.01	
2015/2016	Mary Robinson	Charles King	3.13	
2015/2016	Mary Robinson	Charlotte Roy	3.07	
2015/2016	Mary Robinson	Daniel Lewis	2.69	
2015/2016	Mary Robinson	David Carter	2.02	
2015/2016	Mary Robinson	Donna Nelson	1.88	
2015/2016	Mary Robinson	Elizabeth Hill	2.31	
2015/2016	Mary Robinson	Emily Turner	2.54	
2015/2016	Mary Robinson	Emma Mitchell	2.75	
2015/2016	Mary Robinson	Ethan Thomas	1.98	
2015/2016	Mary Robinson	George Black	2.94	
2015/2016	Mary Robinson	Helen Miller	1.48	v

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User Interface 44 – Evaluations: View

IS to Manage the Evaluation of Employees' Performance in a Preschool



NIB: Evaluation Performance IS

Evaluations: View Details

Evaluated Self-Assessment Date School Centre Class Room
Evaluator Evaluation Date School Year Category

Summary **Transversal** Specific Goals

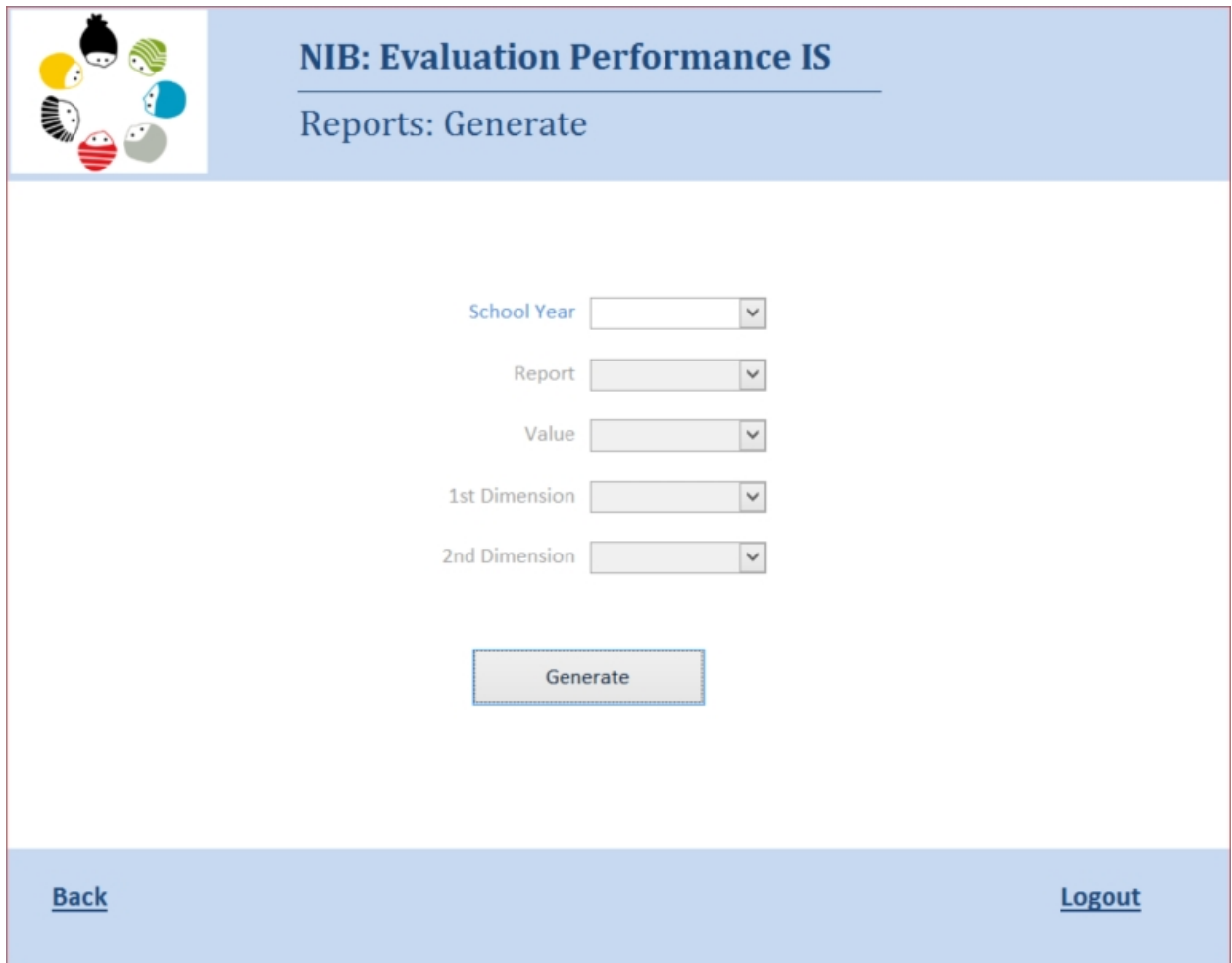
Self-Assessment Score <input type="text" value="1.48"/>	Evaluation Score <input type="text" value="2.43"/>
Evaluated Comments	Evaluator Comments
<input type="text" value="Evaluated comments."/>	<input type="text" value="Evaluator comments."/>

[Back](#)

[Logout](#)

User Interface 45 – Evaluations: View Details

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The interface features a light blue header with a logo on the left consisting of seven stylized faces in various colors (yellow, black, green, blue, red, grey, black). The header text reads "NIB: Evaluation Performance IS" and "Reports: Generate". Below the header, there are five dropdown menus labeled "School Year", "Report", "Value", "1st Dimension", and "2nd Dimension". A "Generate" button is centered below these menus. At the bottom, there are two links: "Back" on the left and "Logout" on the right.

NIB: Evaluation Performance IS
Reports: Generate

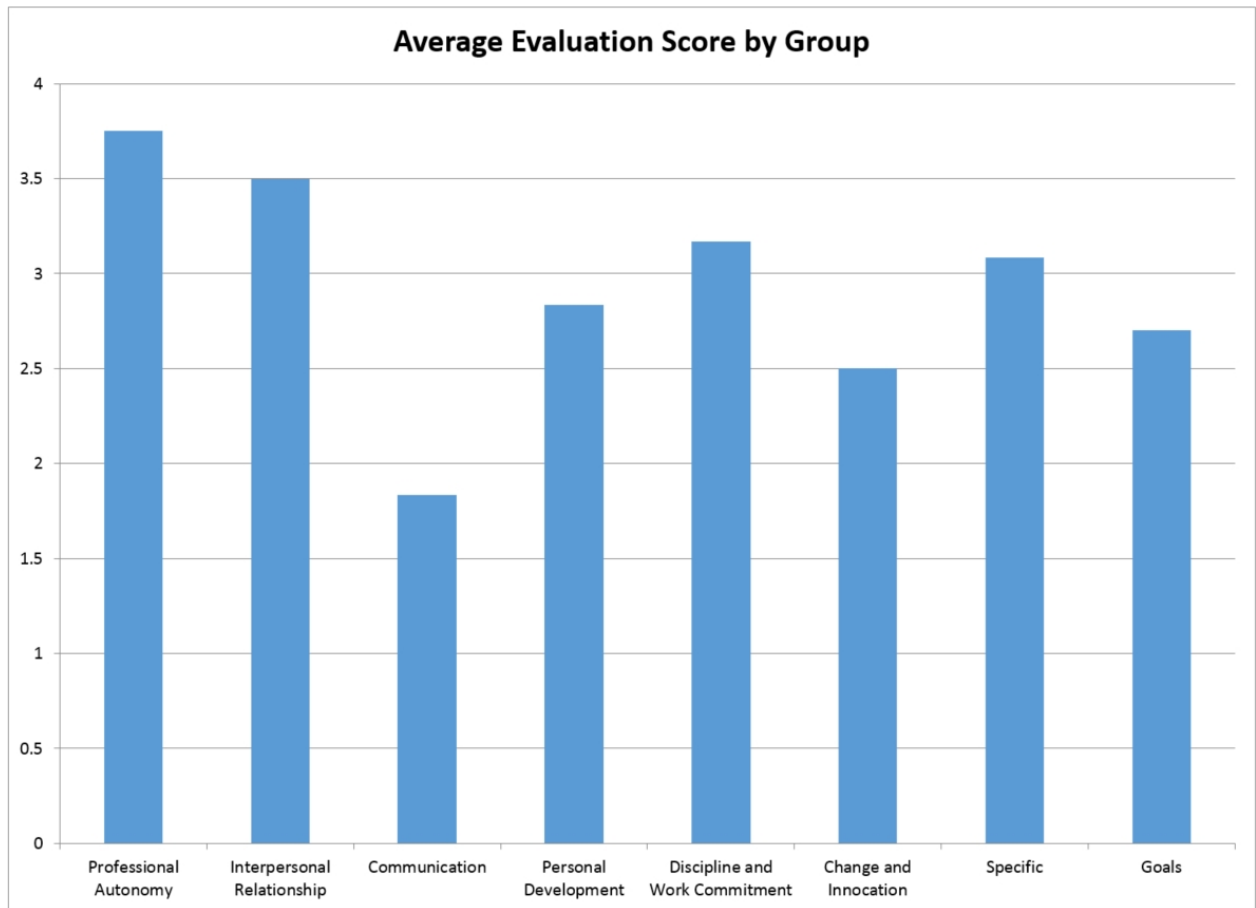
School Year
Report
Value
1st Dimension
2nd Dimension

Generate

[Back](#) [Logout](#)

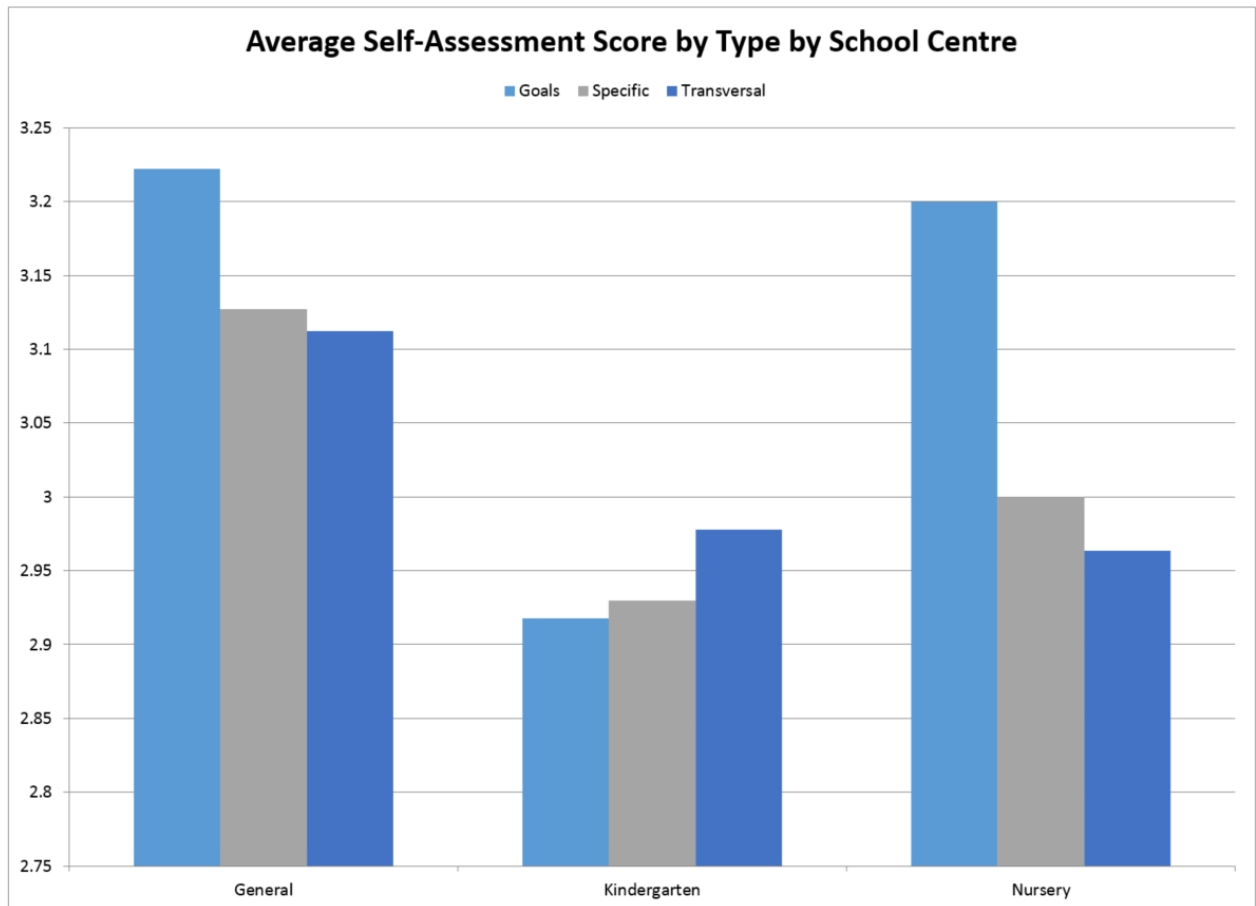
User Interface 46 – Reports: Generate

Appendix E – Examples of Implemented Reports



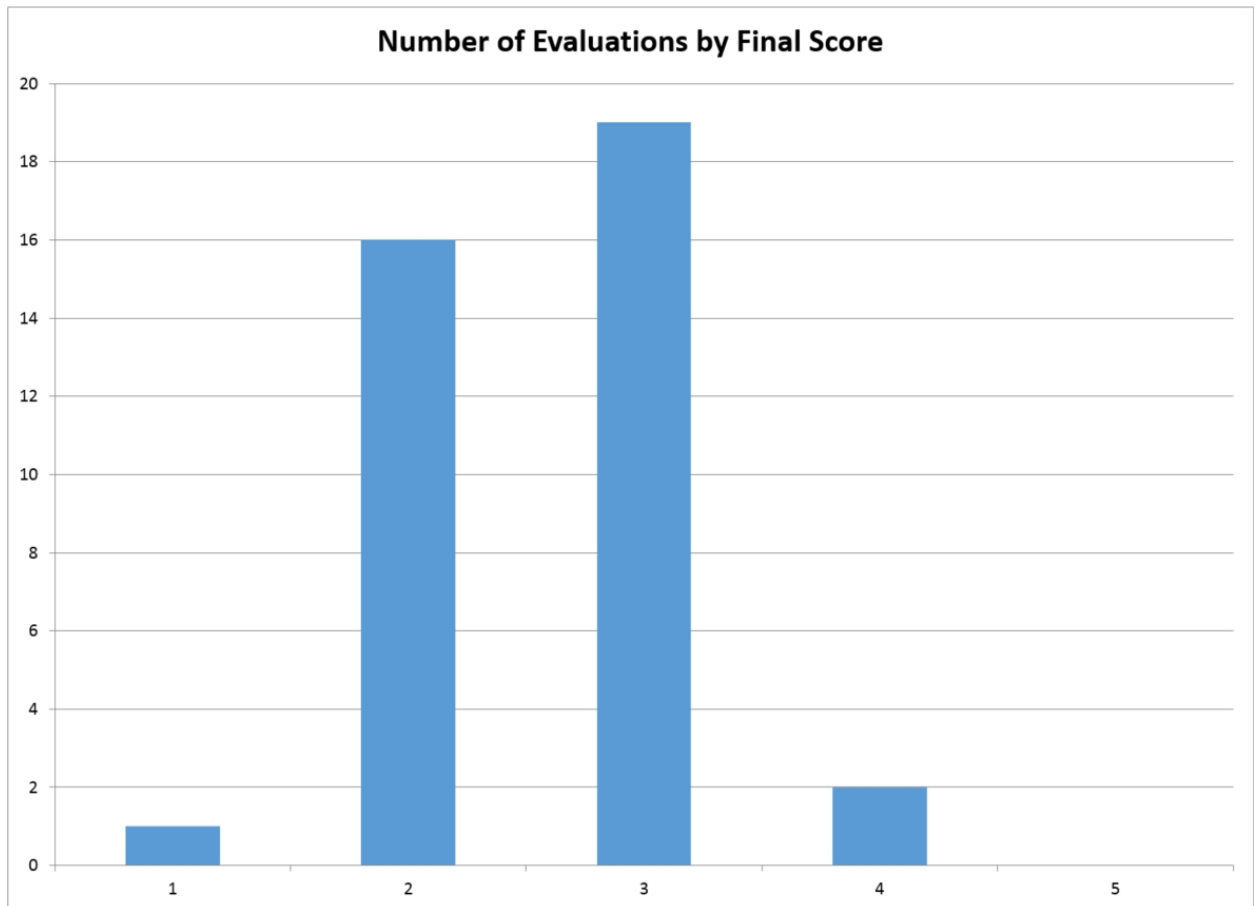
Report 1 – Average Evaluation Score by Group

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Report 2 – Average Self-Assessment Score by Type by School Centre

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Report 3 – Number of Evaluations by Final Score

Appendix F – Implemented Restrictions

The restrictions were implemented using constraints, unique indexes and triggers. In this appendix, the used code is described.

Primary Keys

Here the restrictions are intended to define the identification fields of each table. This means that in the same table there can't be more than one row with the same values in the identification fields. A constraint is created in each table, that imposes this unique identity to each row.

```
alter table SchoolCentre add constraint pk_schoolcentre primary key (ID)
alter table Classroom add constraint pk_classroom primary key (ID)
alter table SchoolYear add constraint pk_schoolyear primary key (ID)
alter table Professional add constraint pk_professional primary key (ID)
alter table Category add constraint pk_category primary key (ID)
alter table ProfessionalSchoolYear add constraint pk_professionalschoolyear primary
key (IDProfessional, IDSchoolYear)
alter table [Type] add constraint pk_type primary key (ID)
alter table [Group] add constraint pk_group primary key (ID)
alter table Question add constraint pk_question primary key (ID)
alter table Evaluation add constraint pk_evaluation primary key (IDEvaluated,
IDEvaluatedSchoolYear)
alter table QuestionEvaluation add constraint pk_questionevaluation primary key
(IDEvaluated, IDEvaluatedSchoolYear, IDQuestion)
alter table [User] add constraint pk_user primary key (ID)
```

Foreign Keys

Here the restrictions are intended to define the fields of each table that directly relate to other tables, using their primary keys. This assures data integrity, since the database can automatically validate the relationships between tables. A constraint is created for each foreign key in each table, indicating the action that should be taken in update and delete actions⁷. When this is not explicit the database won't let the user update or delete the data that relates the two tables.

```
alter table Classroom add constraint fk_classroom_schoolcentre foreign key
(IDSchoolCentre) references SchoolCentre (ID) on update cascade
alter table ProfessionalSchoolYear add constraint
fk_professionalschoolyear_professional foreign key (IDProfessional) references
Professional (ID) on update cascade
```

⁷ These rules were not discussed with NIB, so they should be revised in a next phase.

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```
alter table ProfessionalSchoolYear add constraint fk_professionalschoolyear_schoolyear
foreign key (IDSchoolYear) references SchoolYear (ID) on update cascade
alter table ProfessionalSchoolYear add constraint fk_professionalschoolyear_classroom
foreign key (IDClassRoom) references Classroom (ID) on update cascade
alter table ProfessionalSchoolYear add constraint fk_professionalschoolyear_category
foreign key (IDCategory) references Category (ID) on update cascade
alter table [Group] add constraint fk_group_type foreign key (IDType) references
[Type] (ID) on update cascade
alter table Question add constraint fk_question_group foreign key (IDGroup) references
[Group] (ID) on update cascade
alter table Question add constraint fk_question_schoolcentre foreign key
(IDSchoolCentre) references SchoolCentre (ID) on update cascade
alter table Question add constraint fk_question_category foreign key (IDCategory)
references Category (ID) on update cascade
alter table Evaluation add constraint fk_evaluation_evaluated foreign key
(IDEvaluated, IDEvaluatedSchoolYear) references ProfessionalSchoolYear
(IDProfessional, IDSchoolYear)
alter table Evaluation add constraint fk_evaluation_evaluator foreign key
(IDEvaluator, IDEvaluatorSchoolYear) references ProfessionalSchoolYear
(IDProfessional, IDSchoolYear)
alter table QuestionEvaluation add constraint fk_questionevaluation_evaluation foreign
key (IDEvaluated, IDEvaluatedSchoolYear) references Evaluation (IDEvaluated,
IDEvaluatedSchoolYear) on update cascade
alter table QuestionEvaluation add constraint fk_questionevaluation_question foreign
key (IDQuestion) references Question (ID) on update cascade
alter table [User] add constraint fk_user_professional foreign key (IDProfessional)
references Professional (ID) on update cascade on delete cascade
```

Unique Values

Here the restriction is intended to prevent duplicate values of a non-identifier field, giving the user more consistent data when looking only at the characterizing fields (not the IDs). A constraint is created in each table for each combination of fields intended to be unique. In the case of the Professional ID in the User table, we intend for this field to never be duplicated, unless it is null (this case applies to all administrator users). Since MSS implementation of the unique constraint doesn't allow for duplicate nulls, we used a unique index instead to permit it.

```
alter table SchoolCentre add constraint uq_schoolcentre_description unique
(Description)
alter table Classroom add constraint uq_classroom_description unique (Description)
alter table SchoolYear add constraint uq_schoolyear_description unique (Description)
alter table Professional add constraint uq_professional_name unique (Name)
alter table Category add constraint uq_category_description unique (Description)
alter table [Type] add constraint uq_type_description unique (Description)
alter table [Group] add constraint uq_group_description unique (Description)
alter table [Question] add constraint uq_question unique (IDGroup, IDSchoolCentre,
IDCategory, Question)
alter table [User] add constraint uq_user_user unique ([User])
```

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```
create unique index ui_user_professional on [User](IDProfessional) where
IDProfessional is not null
```

Current School Year

Here the restriction is intended to allow only one school year to be current at a time. A check constraint is created in the table SchoolYear, that uses a function to check if no more than one school year is set as current.

```
alter table SchoolYear add constraint ck_schoolyear_current check
(dbo.validCurrentYear() = 1)
```

```
create function validCurrentYear() returns bit
as begin
    declare @validcurrentyear bit
    declare @count int

    select @count = count(1)
    from SchoolYear
    where CurrentFlag = 1

    if @count > 1
        set @validcurrentyear = 0
    else
        set @validcurrentyear = 1

    return @validcurrentyear
end
```

Distinct Evaluated and Evaluator

Here the restriction is intended to prevent a professional to evaluate himself. A constraint is created in the table Evaluation, that checks if the Evaluator ID is different from the Evaluated ID.

```
alter table Evaluation add constraint ck_evaluation_evaluator check (IDEvaluated !=
IDEvaluator)
```

Evaluation Final Scores

Here the restrictions are intended to allow only final self-assessment and evaluation scores to have values between 1 and 5 inclusive. Two constraints are created in the table Evaluation, one of them to check the self-assessment score and the other to check the evaluation score. Note

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that the evaluation score constraint permits it to be null. The system creates an evaluation after the first time a professional associated to a year asks the system to perform the self-assessment, and fills all the necessary scores. At that time, the database must be capable of storing the data with no evaluation scores, since the evaluation was not performed yet.

```
alter table Evaluation add constraint ck_evaluation_fscore check
((FinalSelfAssessmentScore >= 1 and FinalSelfAssessmentScore <= 5))
alter table Evaluation add constraint ck_evaluation_escore check
((FinalEvaluationScore >= 1 and FinalEvaluationScore <= 5) or FinalEvaluationScore is
null)
```

Question Scores

Here the restrictions are intended to allow only self-assessment and evaluation scores to every question to have integer values between 1 and 5 inclusive. This applies to all questions of type Transversal or Specific. To questions of type Goals, the allowed values should be only 1 and 5. Two constraints are created in the table QuestionEvaluation, one of them to check the self-assessment score and the other to check the evaluation score. Both constraints use a function to check if the value is valid depending on the questions' type.

```
alter table QuestionEvaluation add constraint ck_questionevaluation_sascore check
(dbo.validScore(IDQuestion, SelfAssessmentScore) = 1)
alter table QuestionEvaluation add constraint ck_questionevaluation_escore check
(dbo.validScore(IDQuestion, EvaluationScore) = 1)

create function validScore(@idquestion as int, @score as int) returns bit
as begin
    declare @type varchar(50)
    declare @valid bit

    select @type = t.Description
    from question q
    inner join [group] g
    on (q.idgroup = g.id)
    inner join type t
    on (g.idtype = t.id)
    where q.id = @idquestion

    if (@type = 'Goals' and @score in (1,5)) or (@type != 'Goals' and @score >= 1
and @score <= 5) or (@score is null)
        set @valid = 1
    else
        set @valid = 0

    return @valid
end
```

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Relationships of Question with School Centre and Category

Here the restriction is intended to prevent questions of the Specific and Goals type to not be associated with a specific School Centre and Category. At the same time, it should also to prevent Transversal questions to be associated to any School Centre or Category. The IS is prepared to consider questions that are not linked to any School Centre and Category, to be applied to every evaluation, whilst the questions that are associated, will be applied to the correspondent School Centre and Category. A constraint is created in the table Question, that uses a function to know if a question is of the type transversal and then check if the values of Category and Scholl Centre ID are valid for the current situation.

```
alter table Question add constraint ck_question_transversal check
((dbo.transversal(ID) = 1 and IDSchoolCentre is null and IDCategory is null) or
(dbo.transversal(ID) = 0 and IDSchoolCentre is not null and IDCategory is not null))
```

```
create function transversal(@idquestion as int) returns bit
as begin
    declare @type varchar(50)
    declare @transversal bit

    select @type = t.Description
    from question q
    inner join [group] g
    on (q.idgroup = g.id)
    inner join type t
    on (g.idtype = t.id)
    where q.id = @idquestion

    if @type = 'Transversal'
        set @transversal = 1
    else
        set @transversal = 0

    return @transversal
end
```

Users and Associated Professionals

Here the restriction is intended to prevent main users to have invalid professionals associated, as well as to prevent professionals to have administrator users associated to them. A constraint is created in the table user, that checks if users with administrator flag as false has a Professional ID associated and if users with administrator flag as true doesn't have a professional ID associated.

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```
alter table [User] add constraint ck_user_profadmin check ((AdministratorFlag = 0 and IDProfessional is not null) or (AdministratorFlag = 1 and IDProfessional is null))
```

Create User

Here we intend to automatically create a user every time a professional is created. A trigger is created in the table Professional, that adds a new user to the User table, defining the user as the professional's name without spaces, and the password as "password".

```
create trigger tr_professional_user on Professional for insert as
insert into [User] (IDProfessional, [User], [Password], AdministratorFlag)
select ID, replace(Name, ' ', ''), 'password', 0
from inserted
```