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UNIVERSITY CAMPUS INFORMATION SYSTEM TO ASSESS QUALITY OF LIFE USING USERS' PERCEPTION: A CASE STUDY APPLIED ON THE UNIVERSITY OF MINHO CAMPUS

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RESUMO

Nowadays, quality of life survey is one of the primary concerns in urban planning and management. Its evaluation and monitoring became a challenge that decision makers have to lead with. This paper presents the work that conduced to the development of an information system to evaluate and monitor university campi quality of the life. The system embodies two main functions: to inform, allowing any user to know how has evolved the quality of life on campus; to be a decision support tool, mainly for facilities planning and management, taking advantages of users participation, through individual evaluations, in getting a global quality of life users perception. Using a scenario describing possible actions, some users evaluated how its implementation would interfere with the quality of life on the campus. Results showed that it would produce a global improvement, in comparison to the year of the study.

UNIVERSITY CAMPUS INFORMATION SYSTEM TO ASSESS QUALITY OF LIFE USING USERS' PERCEPTION: A CASE STUDY APPLIED ON THE UNIVERSITY OF MINHO CAMPUS

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ABSTRACT

Nowadays, quality of life survey is one of the primary concerns in urban planning and management. Its evaluation and monitoring became a challenge that decision makers have to lead with. This paper presents the work that conduced to the development of an information system to evaluate and monitor university campi quality of the life. The system embodies two main functions: to inform, allowing any user to know how has evolved the quality of life on campus; to be a decision support tool, mainly for facilities planning and management, taking advantages of users participation, through individual evaluations, in getting a global quality of life users perception. The results of the application of that system in case study are also presented.

1 INTRODUCTION

Universities have been recognized as an important agent in societies' development. One of the landmarks of this recognition was the Magna Charta Universitatum (The Magna Charta Observatory, 1988). The document was signed by all the Rectors who were in Bologna to celebrate the 900th Anniversary of the Alma Mater. In this document, it is assumed that the Universities must keep on being promoters of cultural, scientific and technical development, not only of new generations but also extending his action to the whole society through constant training. They should also provide to the future generations education and training that will teach them, and through them others, to respect the great harmonies of their natural environment and life itself. In this document, recommendations are made in order to contribute to the achievement of these objectives. One of the recommendations is that "Each University must – with due allowance for particular circumstances – ensure that its students' freedoms are safeguarded, and that they enjoy concessions in which they can acquire the culture and training which it is their purpose to possess". In this context of necessary conditions, fits the search for guaranteeing a better quality of life in campus, not only for the students as well as for all users.

Nowadays, besides its specific role in higher level education, university campi have assumed the form and characteristics of urban spaces for several reasons: their location, implanted in mainly urban zones or, in some cases, even merged in the urban tissue; their physical dimension, to which, for example, concerns with internal mobility are associated; their human dimension, which suggests precautions and measures when leading with a significant number of users; and their organisation, influenced by the previous items, outlining different functional spaces, providing all kind of extra curricular activities and functions, but having a not less relevant role in every day users.

In this framework, the main objective was to develop an information system to evaluate and monitor university campi quality of the life. The system embodies two main functions: to inform the whole community, allowing any user to know how has evolved the quality of life on campus and which is the campus status concerning indicators values; to work as a decision support tool, mainly for facilities planning and management, including users participation, through individual evaluations, when calculating a global quality of life index.

2 UNIVERSITY CAMPI QUALITY OF LIFE

Along the last two decades, Portuguese Universities have been doing a strong effort in facilities investment. This was the result of an assumed policy of continued growth. It is agreed that the growing cycle will shortly achieve its limit, as all the initially foreseen valencies are installed, and an increasing offer is not expected due to the predictable demand reduction. The admissible growth will be necessarily focused on the creation of last valencies not yet contemplated and on the demand of new targets, namely at the level of postgraduate and continuous formation.

Through growth consolidation of the existent projects, a process, where the dimension increase will give place to quality improvement, must emerge. Quality of teaching and investigation projects also relies on the quality of the spaces where they are developed. Those spaces can be buildings, with their classrooms, laboratories, and services or exterior spaces on the campi, leisure facilities, or traffic and parking conditions.

From that point of view, two approaches can be considered for the management of physical infrastructures: investments in infrastructures and buildings; and the campus quality of life. The construction effort was not always followed by qualitative measures that could promote a balanced liveability to thousands of students, teachers, investigators, staffs and visitors who daily spend many hours of their life in university campi.

Besides the obvious needs associated to their specific activities, those users aspire to a healthy and secure milieu, with a good and comfortable architectonic environment, with appropriated and well located facilities, with good mobility and accessibility levels, etc. In short, they aspire to a University Campus with quality of life.

Quality of life became a common expression in our vocabulary. But it does not mean this concept has acquired a precise sense. About looking for a definition of a concept as vast as the quality of life is, Tobelem-Zanin (1995) refers to it as essentially a dimension definition problem. However, the author still considers that the concept frontiers remain fuzzy.

3 METHODOLOGY

3.1 Approach

In spite of the known difficulties to find a universal definition of quality of life in urban spaces, there is some consensus concerning the approach conducing to its conceptualization. In this context, and without depreciating the discussion about the conceptual and qualitative aspects, the development of an evaluation and monitoring tool to analyse the quality of life degree provided to campi' users is seen as relevant.

The methodology approach starts with the identification of a set of quality of life dimensions, which are related to aspects of the campi liveability. These dimensions, whose definition will necessarily result from the opinion of a set of users (directly or through a representation scheme) about a "standard" list previously defined, are described by a set of indicators. As dimensions and respective indicators do not have the same relevance in people's perception of quality of life, users should also be consulted in a weighting attribution process. So, using an exhaustive number of indicators that describes several dimensions for the quality of life in campus (QlC), as well as their evaluation and monitoring, it is possible to conceive a system that contributes to the decision making in campus management. The same system will allow the community to have access to relevant information that will help to understand better how quality of life has evolved.

3.2 QlC evaluation and monitoring

Moreover the identification of QlC dimensions and indicators, users should participate in the evaluation model definition and, periodically, in the monitoring of results. Globally, Figure 1 describes the sequence followed by the definition, evaluation and monitoring process.

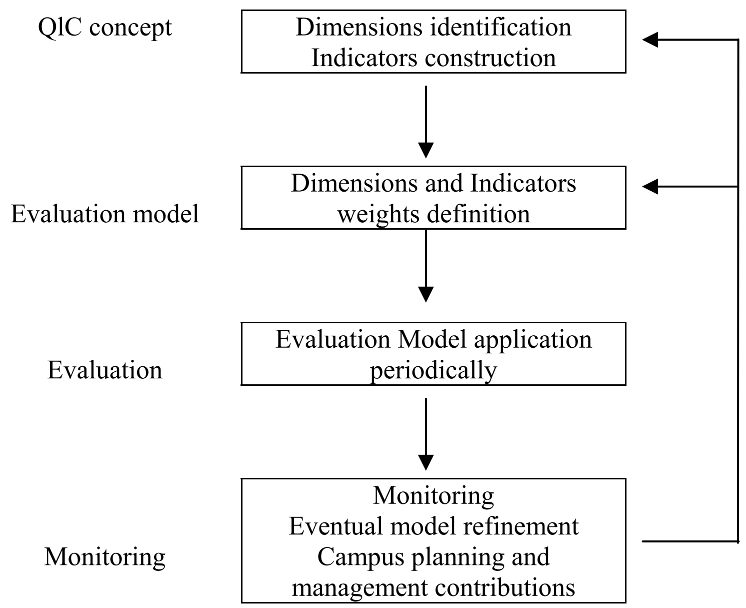

Fig. 1 QlC definition, evaluation and monitoring process

This exercise only does sense if, besides involving the users, it results in contributions for the campi planning and management. For each loop, a report about the "State of the Campus" should be produced, including the indicators evaluation, where it will be possible to identify imbalance and deficit of global quality of life, as well as for each identified dimensions used in the analysis.

3.3 QlC Evaluation model

Considering that the liveability in a university campus is very similar to one of a small city, suffering with the conditioning from many factors, such as the environmental conditions, the mobility, the accessibility to services and work places, and social conditions, it is understandable that a university campus can be seen as an urban space. This idea is reinforced when considering the definition of a city given by Merlin (1994): "a reunion of men, in favourable localization, to drive collective activities, a place for people, wells, capitals, ideas and information exchange, been simultaneously a framework, motor and result of human activities" (free translation). For that reason, the methodology exposed by Mendes (2004) was adopted for the Evaluation of the Quality of Life in University Campi which includes the following steps:

a. To identify the dimensions to be considered in the evaluation of the QlC;
b. To establish a system of weights for the dimensions, through direct inquiry to the users, groups of interest or decision-makers;
c. To identify/build the set of indicators that characterises each one of the dimensions considered. This process is based essentially in the judgement of the investigator about the relevance of the indicators, since its adoption is usually conditioned by the availability of information;
d. To establish a scoring scale for the evaluation of the indicators, properly normalised, allowing its aggregation;
e. To establish a system of weights for the indicators. The weights attributed to the several indicators, inside each dimension, should be based essentially in the judgement of the investigator, due to the specificity of the indicators;
f. To establish the indicator aggregation rules, inside each dimension;
g. To establish the dimension aggregation rules.

In a context where the availability of funding resources is limited and depends on the ability to attract students, planning and management of University Campus will benefit from any kind of support that could supply relevant information, in order to contribute to better decision making when searching the best for the managed institution and for all the users. In this context, a decision support system can be very useful.

3.4 System structure

As it can be seen in the Figure 2, it was idealised a system containing four major components: a database subsystem, a models subsystem, a reports creator and an interface with the community.

The database subsystem includes a database (DB) that stores all the relevant data for the problem, as well as their description (metadata). All data accesses are made through a Database Management System (DBMS). These operations can be creation / insertion, updating or query. The models database subsystem is dedicated to the management, maintenance and operation of models. For such, it integrates a models base (MB) for its storage. As referred for data, there is also a models management system that manages the access process to the models base (MMS). It also allows the creation of new models when using any appropriate tool or programming language. Furthermore, it provides the possibility to interconnect models with proper connections to the data base. The reports creator collects all the necessary procedures and tools for reports creation. It allows us to produce documents of synthesis, analysis and comparative synthesis, which can present the information in tabulate or graphical form, improving its perception and interpretation.

The interface with the community is a subsystem that allows, in a transparent manner, the interaction and operation with the remaining subsystems. Users can participate in the process and take advantages of the available functions, without however being required extended computer skills. For that reason the interface should be based on a well known working environment and with which computer users are more familiarised: the internet browser was elected. Also with the aim to turn interaction with the system as simple as possible, users should only be asked to do basic actions, such as inserting values, selecting items or clicking on buttons to initiate new actions, tasks that are very common when using a web browser.

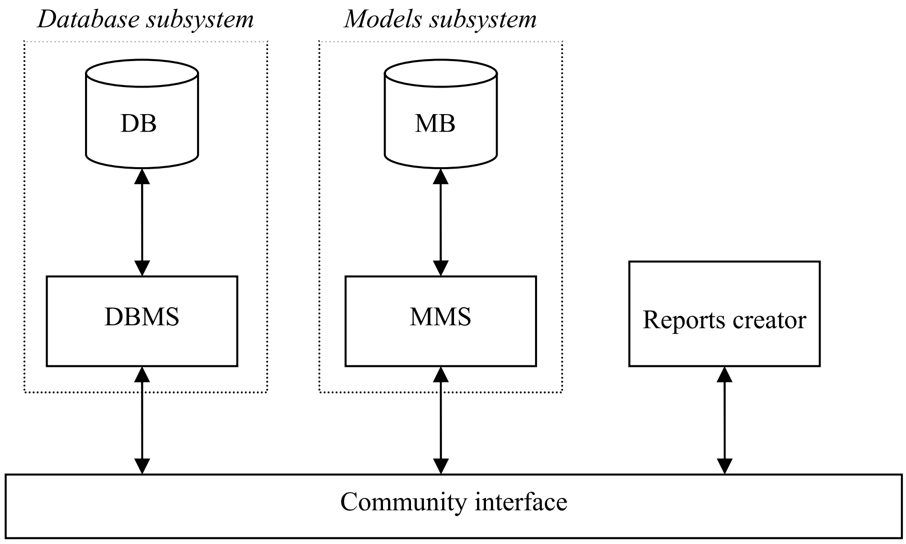

Fig. 2 Model Structure

All the information flows between the several subsystems will not be much perceptible to the user, given that his interaction with the system is established and orientated by the interface. However, these flows exist. The models subsystem queries for data the database subsystem to feed its models. The database subsystem will receive all information that is intended to be stored. The reports creator consults the database and, eventually, the models base to gather all necessary data in reports construction. While administering and orientating all steps given by the users, the interface has the role to start actions or operations that lead to the appearance of these flows. It has also the task of directing these flows between the several subsystems, in order to guarantee expected results (for example, to store new values or to supply a user with results).

3.5 Indicators

The choice of indicators depends on definitions (which are context dependent); their representation at a given moment and over time; measurement techniques; their compatibility and predictive accuracy; and their purpose, which is related to the objectives and priorities of those who use them. They are also affected by the kinds of information that are available or that can be obtained, the pertinence of that information, and its level of abstraction in relation to concrete themes or subjects (OECD, 1997).

With the objective to monitor Campus Quality of Life, a list of indicators was created. This list is the result of the consultation of reference bibliography and works developed in this field, and the interaction with elements of decision and management organs of the campus chosen as case of study. Indicators were grouped by dimensions. As a complement to this grouping form, themes were introduced as an intermediate level. This structure brings some benefits: when searching and selecting indicators, it allows to define better the extent of this task, defining sub-contexts of quality of life intended to be characterized; when using those indicators in the evaluation, it is possible to reflect this structure to indicators selection, combination and even weights assignment operations. Table 1 (adapted from Rodrigues, 2007), presents the indicators themes selected for the five dimensions considered.

Table 1 QlC dimension and indicators themes

QlC Dimension	Theme
Environment	Environmental noise Air quality Waste management
Mobility and Parking	Campus accessibility level Campus accessibility level for handicaps Internal road network Internal pedestrian network Pedestrian accessibility ratio Handicaps accessibility ratio Parking offer Public transport Service level of the axis campus-city
Safety	Crimes in campus Campus surveillance Fire fighting Evacuation exercises
Urban Space	Functional zoning Urban furniture Internal signalling Campus works
Support services	Food and drinks Shopping Services Leisure and culture Sports

4 A CASE STUDY APPLIED ON THE UNIVERSITY OF MINHO CAMPUS

The previously presented methodology was implemented and tested as a case study developed at the Gualtar Campus of the University of the Minho, Braga, Portugal. That Campus lays on a peripheral area of the city of Braga, between the east side of the city and the former village of Gualtar. It occupies an area of twelve hectares. The community of the Campus has about 13100 users, with 12000 students, 800 lecturers and 300 staff employees. The buildings support academic activities, congregating Schools and Institutes, three Classroom Complexes and several buildings for services, such as the Library, the Computational Centre, the Academic Services, the Sports Complex, and so on.

4.1 Scenario

To validate the model and the system, a set of members of the academic community was invited to individually evaluate the quality of life variation between the base year of 2006 and a scenario for 2007. Each campus user had to choose the indicators that he wanted to consider, and had to assign them weights that would be applied in further calculations.

Data referring to the year 2006 served as a base for the creation of the above mentioned scenario, i.e. new values were assigned to some indicators whereas the remainder, which were considered unchanged, maintained the same previous value (equal to the base year). Updating the value of an indicator did not simply result from an act of insertion of a new value, but from the consideration of possible events or interventions on the campus. This assumption can lead to the change of several indicators values that could be affected by a particular event. For instance, if we consider the possibility of planting more trees, the scenario will reflect this action by the assignment of new values to indicators like the, number of trees and the number of trees by hectare. In that way, a scenario year intends to represent possible interventions on the campus that could provoke a quality of life variation, updating affected indicators values.

The scenario for 2007 resulted from considering the possibility:

i) of installing a new recycling container to improve actual coverage (to reduce the distances) of the campus. This deficient situation can be observed in Figure 3, where a map that illustrates the distance to the nearest recycling container from any point on the campus is presented. It implies the assignment of a new value to indicators total number of recycling containers and total number of recycling containers per hectare;

ii) of increasing to 14 the number of daily buses running between the campus and the city centre, from 8am to 8pm;

iii) of installing 6 new exterior fire hydrants to reinforce the existent net. The affected indicators are a number of exterior fire hydrants, a number of exterior fire hydrants per hectare and a number of exterior fire hydrants per 1000 m2 of construction (implantation);

iv) of planting 50 new trees, trying to improve the physical and natural environment of the campus, the indicators total number of trees and total number of trees per hectare received values that reflect this changing;

v) of constructing the new building announced in the UMDicas newspaper (published by the university social services), which will include a new sports complex, a cardio-fitness room and a medical centre; it affects several indicators, distributed on more than one dimension. With an area of approximately 782 m^2, this value was added to the existent value for area of indoor sports equipment, leading consequently to a new value for the area of indoor sports equipment per 1000 users. Due to the fact that a part (179 m^2) of the new facility will occupy a portion of space devoted to the practice of outdoor sports, this will have an impact on subsequent indicators, the outdoor sports equipment area and the outdoor sports equipment area per 1000 users. If until now the dimension support services, and its theme sports, were only a target of a closer look, that kind of intervention on the campus also has an impact on the dimension urban space, namely on the functional zoning theme. So, there is an increase of the built area, as for implantation, as for pavements. Consequently, the value of other indicators must be re-calculated, as long as they are directly related with the previous ones. In this situation, we found the built area (pavements) per user, the built area percentage and the construction rate;

vi) of installing another Automatic Teller Machine (ATM), that would improve the coverage of this type of equipments, namely in the sports complex where the offered services require payments;

vii) of increasing the medical support to 10 hours, making it available from Monday to Friday, even for short periods of 2 hours;

viii) of improving the wireless network coverage, especially outside buildings that for now is only available indirectly (only when in range of inside buildings network coverage).

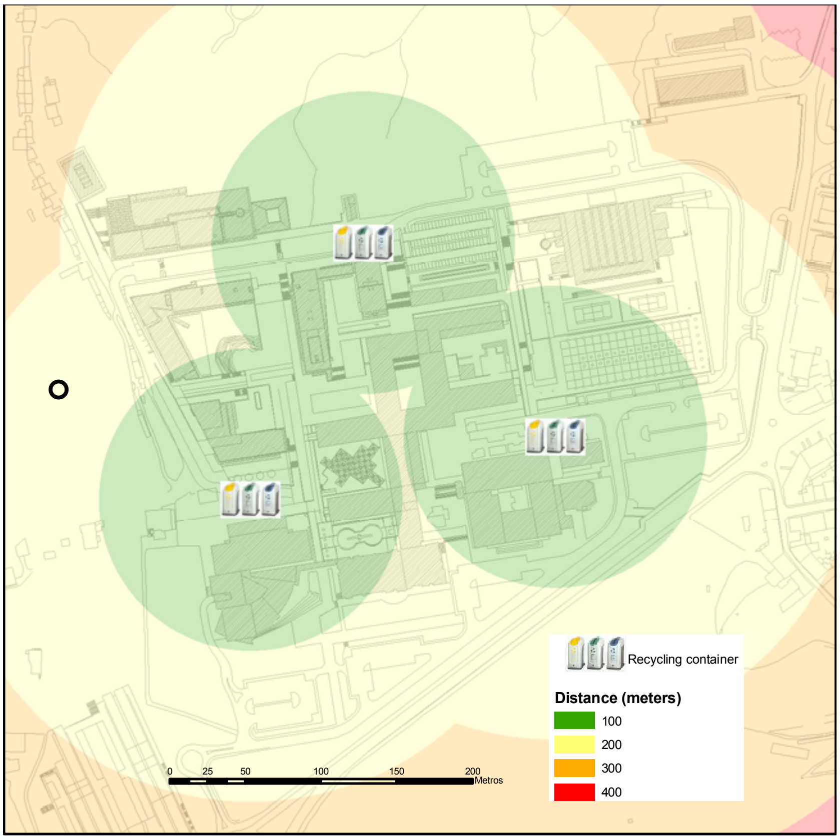

Fig. 3 Distance to the nearest recycling container map

In Table 2, new indicators values that reflect the considerations described previously are presented. As a reference, it is also shown the value referring to the year 2006.

4.2 Weights

During the process of individual evaluation of quality of life, all data inserted by the users are stored by the system. One of these data is the weight assigned by each user to indicators, themes and dimensions. The quality of life variation evaluation by groups of users depends on the system ability to process this information: weights must be derived for the evaluation by group. This task consists in, for each group, gathering all data associated to the group. Then, it is then possible to calculate weights for each indicator, theme and dimension, regarding each group. It is performed by calculating the average of weights assigned by users belonging to the same group. Since participants had the possibility to select only some indicators to carry out their evaluations, it was adopted that the calculation of indexes by groups would include the whole set of indicators. For that reason, to all unselected items in individual evaluations was assigned a weight of 0.

Table 2 Scenario indicators new values

Environment/waste management	2006	Scenario
Total number of recycling containers	3	4
idem, per hectare	0,21	0,28
Mobility and parking/ public transports		
Number of daily buses running between campus and the city centre, from 8.00h to 20.00 h	66	80
Safety/ Fire fighting		
Number of exterior fire hydrants	14	20
idem, per hectare	0,97	1,38
idem, per 1000 m2 de construction (implantation)	0,40	0,57
Urban space/ functional zoning		
Built area (implantation)	35300	36082
Built area (pavements)	85327	86109
Idem, per user	7,43	7,50
Percentage of built area	24,3	24,9
Construction index	0,59	0,59
Urban space/ urban furniture		
Number of trees	661	711
Support services / Services		
Number of ATM	5	6
Medical support	4	10
Percentage of wireless network coverage	24	40
Support services/ Sports		
Area of indoor sports equipment	3600	4382
Idem, per 1000 users	313	381
Area of outdoor sports equipment	2350	2171
Idem, per 1000 users	205	189

Table 3 shows the weights obtained for the dimensions and for each users group. These values correspond to the participation of 45 students, 8 teachers and 10 members of the administrative staff. This panel of participants intended to represent the different groups of users existing in the academic community, namely in this phase of system test. It can be noticed that different levels of importance were conferred to the dimensions.

Table 3 – Dimensions weights by groups

	Students	Teachers	Staffs	Community
Environment	0,206	0,206	0,218	0,208
Parking and mobility	0,197	0,212	0,194	0,198
Safety	0,206	0,230	0,218	0,211
Urban space	0,181	0,164	0,181	0,179
Support services	0,210	0,188	0,190	0,204

4.3 Normalization

For the scenario described previously, Table 4 shows how the variation of each affected indicators is numerically translated by the normalization process. This process consists in comparing each new indicator value to those from the base year, calculating a normalized value that will reflect the variation between them. These values are expressed in a scale that uses as a reference the value (index) 100 – which corresponds to the reference situation (2006 values). For instance, if the scenario proposes an improvement of the percentage of wireless network coverage from 20%, in 2006, to 40%., then the normalized value for this indicator will be 167.Only these indicators are shown, since the remainders still unchanged, i.e., their normalized value is equal to 100 (reference value).

Table 4 Scenario indicators normalized values

Total number of recycling containers	133
Total number of recycling containers, per hectare	135
Number of daily buses running between campus and the city centre, from 8.00h to 20.00 h	121
Number of exterior fire hydrants	143
Number of exterior fire hydrants, per hectare	142
Number of exterior fire hydrants, per 1000 m2 of construction (implantation)	140
Built area (implantation)	98
Built area (pavements)	99
Built area (pavements), per user	99
Percentage of built area	96
Number of trees	108
Number of trees, per hectare	107
Number of ATM	120
Number of ATM, per 1000 users	118
Percentage of wireless network coverage	167
Medical support	250
Area of indoor sports facilities	122
Area of indoor sports facilities, per 1000 uses	122
Area of outdoor sports facilities	92
Area of outdoor sports facilities, per 1000 users	92

4.4 Results

The last step of the quality of life variation evaluation process consists in calculating indexes for each group. This task implies the application of the weights referred previously (Section 5.2). Table 5 shows indexes obtained for each campus user group.

Table 5 Quality of life variation indexes by group

Group	Index
Students	107,4
Teachers	108,0
Staff	107,7
Community	107,5

As it can be seen in table 5, the implementation of the evaluated scenario would origin a positive variation of the quality of life for all the groups, i.e. the obtained indexes are all greater than 100 (base value). Presented values do not differ much. This can be justified by the fact that users did assign weights in a manner quite similar. Even short, the biggest difference is found between the students index and teachers one. This gap happened because the teacher group took some different options when assigning weights when comparing to the remaining groups.

The system also provides graphical results. Charts are used to show the QlC variation by dimension. With that kind of representation, it is possible to observe how each dimension has contributed to final indexes. For example, Figure 4 shows that Environment dimension got a value greater than 100 for each group. It means that the QlC variation is always positive, i.e., in any case, this dimension contributed positively for the global index. Looking at the results by group, it can also bee seen that they were quite similar, since only the value for Teachers is different from the others.

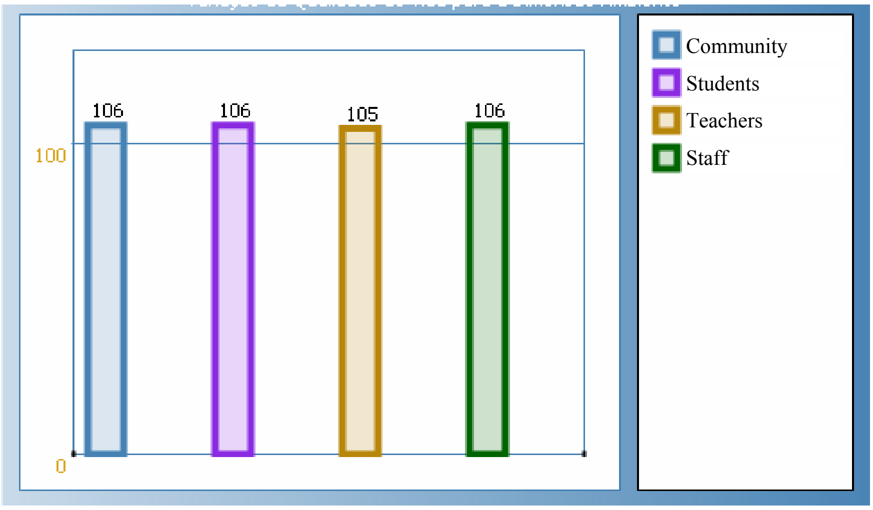

Fig. 4 Quality of life variation for the Environment Dimension

Analysing the other dimensions graphs - see Rodrigues (2007), the differences between the groups indexes values, when they exist, were never greater than one positive point. When comparing those values de reference indexes (100), the dimension urban space and the dimension mobility and parking presented a variation never bigger than one point. The others revealed a variation more significant with a difference of five, six or seven points. However, the dimension safety got results that are beyond those, presenting a variation of twenty-two points for teachers and twenty-three for the other groups.

5 CONCLUSIONS

Basically, the presented model aims to determine a global index of the Quality of Life in Campus (QlC) variation, comparing a given year to a reference year. Comparing directly a set of indicators, this index allows to evaluate how QlC has evolved in general terms. If results are analysed at the indicator level, i.e. studying the variations of each indicator, it is possible to identify which ones did contributed more significantly to QlC variation trend.

To collect necessary data, the system has to save all the individual evaluations. The participation of a set of students, teachers and staffs was crucial, namely when defining the dimensions, themes and indicators weights. Furthermore, with collected data in a proper data structure, the ability of producing groups and global indexes was implemented. Gathering information and opinions was helpful and allowed its functionality validation.

Thanks to the storage of individual participations, the process for calculating of indexes of QlC variation by users groups became possible. Providing this function, the system can effectively work as a decision support tool for campus planning and management, when searching the satisfaction of users needs. Furthermore, it is also possible to involve the community, and information, that was unavailable or was available but diffuse, can be accessed by everyone through the system.

Using a base year when calculating general indexes of QlC variation made possible to collect information useful for temporal analysis. So, it is possible to compare several years to a common base year, showing obtained indexes and allowing the search for a tendency. For a time period where data of different years are available, a QlC variation evaluation can be carried out using successively each year as a base year. The variation will be calculated when comparing to the first following year in the chronological order. Indexes refer to comparisons of pairs of years that cover the whole studied period.

The system's outputs can be used to analyse the quality of life variation profile using as a perspective the adopted dimensions. This kind of analysis is relevant when it is essential to know how each dimension contributes contribute to the global index.

The system also has an informative function, through the providing of ad-hoc analysis. A user can go through the database and access the whole available information related to the indicators. As long as it was required by any item or items were better understood graphically, maps were created using a geographical information system, improving the readability of the information.

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