

# Diagnostic evaluation of needs in an environmental education center through data multiple triangulation

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## Abstract

In this paper we try to show the importance involved implement needs assessment processes in order to establish prioritization of claims collected from the implementation of data multiple analytical triangulation processes. The experience has taken as a case study an environmental education center in the province of Granada (Spain) where it will develop an intervention program with people with sensory disabilities. The results obtained and validated with the multiple analytical triangulation strategy has favored the clustering and distribution of needs in large dimensions by the degree of agreement established through percentiles as cut-off marks and groupings of cluster analysis. In this way, we have inferred a first group of high priority corresponding to the Adaptation of Socio-environmental actions for Sensory Disabled. Secondly, we found a group of moderate priority and that could be identified with the Training and Sensitization of Sensory Disabled through Socio-environmental Actions. Finally, we contemplate a third group of low priority that we could call Design and Planning of Socio-Environmental Actions for Sensory Disabled. On the other hand, the fundamental contribution of this work has been to present results and conclusions truly combined with the objective of validating the previously exposed hierarchy of Socio-environmental needs.

## Keywords

Needs assessment – Data triangulation – Environmental education centers – Methodological advance.

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## Introduction

As reflected in the title of this work, its fundamental purpose is to validate a diagnosis of needs through a complex process of methodological triangulation. From this perspective, we find the three elements that compose the gears of this methodological experience of an environmental nature, namely:

- a) diagnosis in socio-environmental needs;
- b) in an environmental education centre; and
- c) through multiple methodological triangulation as a strategy of validation and legitimation in its approach as convergence.

Let us remember in this regard that the diagnosis of general needs can be considered as “a planned action aimed at obtaining information about the problem to be treated or the situation that we wish to modify with an educational or assistance intervention” (ÁLVAREZ ROJO, 2002, p. 54). For Álvarez Rojo (2002, p. 57-58), the main reasons for recommending needs assessment when a future social intervention is to be carried out are to:

- offer basic information for the determination of existing gaps and opportunities for action;
- encourage the decision-making process from the intended objectives and the characteristics of the intervention;
- provide necessary information to involve the people directly affected by the action to be developed; and
- provide the adequate information to socially and institutionally justify the socio-educational action to those directly and indirectly responsible for the intervention.

However, and as the second element of this work, we highlight the term Environmental Education Centre (EEC)<sup>2</sup>. Before trying to define an EEC, we show some key ideas of another term in which it is intimately incarnated, that is, with the term “environment”.

The first noteworthy aspect is that it would be a term of difficult terminological precision due to its complexity, lack of definition and interrelation with diverse and different factors (BACA; BOSKER, 2000; PEREIRO, 2001; CABANILLAS, 1996). The second aspect is that despite this, we can say that the term “environment” is related to the concepts of ecosystem, habitat, natural resources and ecology, among others. From here, we can define environment as a concrete scenario formed by many elements in which man, both individually and organized into a social group of any scale and level of complexity, develops its multitude of activities (REBORATTI, 2000). Another interesting definition is that indicated by the RAE (Real Academia Española [Royal Spanish Academy, RSA]) as a term referring to the circumstances surrounding people or things. This meaning coincides with one of the meanings of the word medio (medium), which would lead us to affirm that the expression “environment” is redundant. However, the terms medio and environment are used interchangeably to refer to the same concept (BUSTAMENTE, 1995).

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**2-** From now on EEC.

Turning back to the EEC, we can affirm that the manual's definitions configure them as establishments in which comprehensive programmes and processes of environmental sensitization are implemented based on knowledge and awareness of the defence of natural values, etc. Therefore, we can affirm that EEC becomes

[...] spaces for reflection, inquiry, research and citizen participation in environmental awareness processes in order to facilitate knowledge, sensitivity and the development of pro-environmental actions in the effort to minimize the environmental problems of the context where they are inserted. (GRACIA et al., 2013, p.139).

The research that concerns us has as a frame of reference an Environmental Education Centre located in a rural municipality of the province of Granada (Spain), surrounded by a rich natural environment that has numerous facilities, resources and educational programmes that establish guidelines for sustainable intervention and environmental awareness.

The third element in the list is triangulation. It is not strange –indeed, it is typical– to find research reports, articles, papers, and communications of a scientific nature in which it is unashamedly stated to have implemented processes of methodological triangulation in its different typologies. Without going deeply into fundamental questions that could challenge these claims, we agree with Yeasmin and Ferdousour (2012), Torrance (2012) and Van Drie and Dekker (2013) that many of these works do not comply with the logic of triangulation despite the fact that they fly its flag. What usually appears as a work of triangulation becomes what Bericat (1998) calls the strategy or pathway of complementation.

In this sense, complementation is not the same as triangulation because the final product of this type of multi-method design is usually a report with two very different parts, each of which exposes the results achieved by the application of the corresponding research pathways implemented (methods, information-gathering techniques, informants...). Although a degree of integration exists, it is minimal and its legitimacy is based on verifying the degree to which each angle is capable of revealing different and interesting areas of social reality. Faced with this position, however, in the logic of triangulation, the degree of integration increases in relation to complementation, and legitimacy is based on capturing similar facets of social reality from opposite poles, obtaining a final product in which the comparison is sought and is quite convergent and quite divergent. In our case, the pretence of multiple triangulation implemented is the convergent validation in the prioritization of a needs analysis in an environmental facility in the province of Granada (Spain).

## **Methodological triangulation as a validation strategy**

For Erazo (2011), triangulation in qualitative research is one of the basic requirements of credibility of the obtained findings. However, we have to go back a long time to the seminal works of Campbell and Fiske (1959), Denzin (1978) and Jick (1979) to

find triangulation as a plausible strategy for validating results. In essence, triangulation consists of documenting information and contrasting it according to different points of view, which is why we talk about the triangulation of techniques, agents, times, and even methodologies. As a contrast technique, it reveals the contradiction, inconsistency or convergence between data obtained by different sources, as proven by, among others, the works of Bjurulf et al. (2013), Brown et al. (2015), Flick (2005), López et al. (2013), Teixeira et al. (2012), Van Drie and Dekker (2013). In addition, with Barusch et al. (2011), Bekhet and Zauszniewski (2012), Beattie et al. (2005), Hind (2017), Newman et al. (2013), Oelinik (2015), Okoe and Boateng (2016), Schraeli et al. (2017), Stutz (2016) and Torrance (2012), we can affirm that triangulation strategies allow the exercise of quality control over qualitative research processes, offering confidence tests and guarantees that the results and findings proposed there meet minimum requirements of credibility, rigor, veracity and robustness.

Triangulation consists of a procedure by which the researcher takes a series of precautions throughout the planning, design, development and diffusion of the research so that their work does not suffer from serious scientific biases. These strategies do not exclusively affect the techniques and instruments but also affect the agents that collect this information, the different moments in which the research is developed and organized, the methods, the different contexts, the sources of documentation, etc. Triangulation has been defined as a way to improve the results that a researcher obtains after applying a specific technique to his or her work (GORISSEN et al., 2012).

Therefore, triangulation is a strategy for the quality control of qualitative research, which gives us guarantees and confidence regarding the methodological goodness of our findings. The idea of quality in qualitative research is generally associated with the idea of credibility in the work of researchers (RODRÍGUEZ et al., 1999; SANDÍN, 2000; CRESWELL, 2005; RODRÍGUEZ-SABIOTE; LORENZO-QUILES, 2005; MORAL, 2006; MORSE, 2006; TÓJAR, 2006; BROD, TESLER; CHRISTENSEN, 2009; DENZIN, 2010; OLABUÉNAGA, 2012). Some people, however, consider triangulation as a strategy that is too incomplete and weak compared to what they call crystallization (RICHARDSON, 1997). While the triangle is erected in a rigid figure, fixed in two dimensions [...] “the crystal combines symmetry and substance with an infinite variety of shapes, substances, transmutations, multidimensionalities, and angles of approach” (p. 92).

One might ask then if perhaps what this author advocates with an impeccable literary style is not similar to the complex processes of multiple triangulation that combine, contrast, compare, etc., different points and infinite levels of triangulation that comprise a vast and complex structure that can resemble the polyhedral contours that make up the crystallization.

In this context of questioning, it is important that the assessment of quality in design and development can and should be carried out either by the researcher himself or by other agents involved. In both cases, sufficient evidence must be given that the procedure followed in the investigation has been correct, that all relevant cases have been selected without ignoring those that could represent negative evidence

in relation to our interests, that the data collection has been adequate and without pitfalls, and that the data analysis procedures have been followed without forcing the results in any tendentious direction. All these strategies constitute fundamental action guidelines for quality research (RODRÍGUEZ et al., 1999); in all of them, the triangulation processes of information play a key role. “An exclusive trust in a method may polarize or distort the researchers view of the particular slice of reality that he or she is investigating” (COHEN; MANION, 2002, p. 332).

## **The proposal implemented**

To prioritize the analysis of the needs of environmental facilities through multiple analytical triangulation strategies, we propose a procedural model structured in various stages. In its development, we will start with a basic approach by Gracia et al. (2013), whose fieldwork was developed during the spring of 2011 in an environmental facility of the province of Granada (Spain) and that consisted of the deployment of several techniques for collecting information: internal facility documents, taking photographs and conducting interviews with various agents. These agents (relatives of children with visual needs who visited the facility, environmental education teachers of the facility, and special education teachers not belonging to the facility) were selected by theoretical sampling strategies related to such environmental facilities. In this work, the authors proposed a process of multiple triangulation for the analysis and prioritization of the environmental facility needs of the province of Granada (Spain) that were addressed in a basic manner and in which conclusions were presented. Although this approach is legitimate, we have considered that it could be improved with the methodological triangulation model in phases proposed by Rodríguez-Sabiote and Gutiérrez-Pérez (2005) and Rodríguez-Sabiote et al. (2006) and that we will now detail.

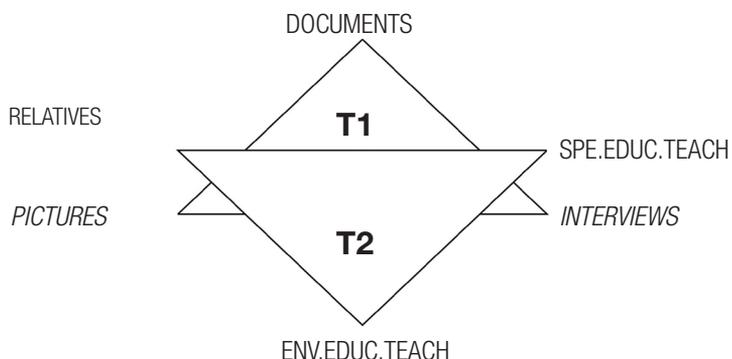
### **The development of some type of methodological triangulation**

Initially, it is obvious that it is necessary to implement some type of methodological triangulation in its different typologies. It is true that the logic of the model contemplated favours qualitative methodologies and techniques, given that it is based on presences vs. absences of the needs and less on the quantitative dimension of those needs. In our example, Gracia et al. (2013) proposed a nested multiple triangulation with two points of triangulation (T1 and T2) and various levels of triangulation:

*Triangulation point 1 (T1):* Techniques: Internal documents (Centre project), other documents, photographs and interviews (4 levels of triangulation).

*Triangulation point 2 (T2):* Agents: Relatives of children with visual needs, special education professionals, and environmental education professionals (3 levels of triangulation).

**Figure 1** - Structure of the multiple triangulation developed



Source: Own elaboration.

## Results

### Analysis of the information collected at the various points and levels of triangulation

The detailed analysis of the information collected, which is not appropriate for the present work and which the interested reader can consult in Gracia et al. (2013), gave as a result the verification (or lack thereof) of the needs contemplated in each of the levels of triangulation. In this sense, the presence or absence of the evaluated needs was considered and therefore the degree to which these needs were verified, quantitatively speaking. However, regardless of the qualitative tradition in which the work is incarnated, we know that the authors implemented the strategy suggested by Boeije (2009), Gibbs (2012), Gibson (2009), Rodríguez et al. (1999) and Saldaña (2013) based on the already-classical assumptions stated by Miles and Huberman (1994, p. 429), namely, reduction of information, disposition and transformation of data and, finally, formulation and verification of conclusions. Therefore, it is not strange that our third phase, once the analysis phase is over, is the disposition and transformation of the data.

### Disposition and transformation of the data obtained in triangulation points in a matrix of presences vs. absences

Once the presence or absence of the need has been confirmed at the triangulation points, after the relevant analysis processes to which the information collected has been submitted, Gracia et al. (2013) arranged a double-entry data matrix through which, with an “x” for presence and a blank cell for absence, the disposition of the needs is indicated in the triangulation points and levels. In more detail, the following was the detailed matrix:

**Table 1-** Matrix of presences vs. absences of socio-environmental needs in the different levels of triangulation

NEED	TRIANGULATION Nº1: TECHNIQUE			TRIANGULATION Nº2: AGENTS		
	DOC	PIC	DOC <sub>internal</sub>	REL	SET	EET
N1	X				X	
N2	X			X	X	X
N3		X				X
N4		X	X			
N5		X				
N6		X	X	X	X	X
N7						
N8			X	X		
N9			X		X	
N10			X			X
N11			X			
N12			X			
N13				X	X	X
N14				X	X	
N15				X	X	X
N16				X	X	X
N17				X		
N18				X	X	X
N19				X	X	
N20					X	
N21						X

Key: DOC: Internal documents and others documents; PIC: Pictures; INT: Interviews; REL: Relatives; SET: Special Education Teachers; EET: Environmental Education Teachers.

Source: Gracia et al. (2013, p. 135).

Now, we turn to the initial contribution of these authors. Its final result was this matrix of presences vs. absences of the needs observed in an environmental facility as a previous step in its hierarchy during the implementation of an intervention programme with people with sensory needs.

Alone, this double-entry matrix is not entitled to a process of multiple methodological triangulation, although it started from a double triangulation of agents and techniques of information collection. Something more is needed; the interaction, the comparison of information from different prisms. Therefore, this work suggests in the first place a transformation of the initial matrix of presences vs. absences by means of what we have denominated a coverage

### The creation of the coverage or coverage map

A subsequent evolution, that is to say, what is called transformation of the initial data, is the percentage presence of each need when crossed with each level of triangulation (horizontal logic). These data intuitively reveal the importance that each need acquires when being judged from different prisms. For this, we have calculated an index, the coverage index, with two modalities: ratio and percentage. The coverage index is defined as follows:

a) Ratio:  $IDen = \frac{\text{number of levels of triangulation in which the need is the present}}{\text{number of total levels of triangulation considered}}$ ; and

b) Percentage:  $IDen\% = \frac{\text{number of levels of triangulation in which the need is the present}}{\text{number of total triangulation levels considered}} \times 100$ .

With this, we are also configuring what we have called the coverage map, which is nothing more than the greater or lesser presence percentage of each need by levels of triangulation through the allocation of shading using a horizontal layout. The coverage map of the example that concerns us in its entirety would be the following:

**Table 2-** Map of coverage of socio-environmental needs in the different levels of triangulation, along with their corresponding index and coverage percentage

NEED	DOC	PIC	DOC <sub>internal</sub>	RELAT	SEP	EEP	Cov.ind. %	Cov.ind. rate
N1	16.6%				16.6%		33.3%	0.33
N2	16.6%				50%		66.6%	0.66
N3		16.6%				16.6%	33.3%	0.33
N4			33.3%				33.3%	0.33
N5		16.6%					16.5%	0.16
N6				83.6%			83.6%	0.83
N7		16.6%					16.5%	0.16
N8			33%				33.3%	0.33
N9			16.6%		16.6%		33.3%	0.33
N10			16.6%			16.6%	33.3%	0.33
N11			16.6%				16.6%	0.16
N12			16.6%				16.6%	0.16
N13					50%		50%	0.50
N14				33.3%			33.3%	0.33
N15					50%		50%	0.5
N16					50%		50%	0.5
N17				16.6%			16.6%	0.16
N18					50%		50%	0.5
N19				33.3%			33%	0.33
N20					16.6%		16.6%	0.16
N21						16.6%	16.6%	0.16
S needs by level of triangulation	2	5	7	10	11	9		

Caption: DOC: Internal documents and other documents; PIC: Pictures; INT: Interviews; RELAT: Relatives; SEP: Special Education Professionals; EEP: Environmental Education Professionals; Cov.ind.%: Coverage index (percentage); Cov.ind.: Coverage index (rate).

Source: Own elaboration.

## The prioritization of needs based on the coverage indexes and the coverage or coverage map

The final step, once the previous steps have been implemented, is to determine which needs are more or less important from the coverage indexes and the map of presences vs. absences. As a result (their comparison), both determinations will a final analytical-type triangulation (T3).

## The prioritization of needs based on coverage indexes

To determine which needs are more or less priority based on the coverage indexes, we recommend the use and calculation of position measurements in their various modalities (percentiles, quartiles...) with the objective of establishing three similar groups of needs, according to their priority level. In the case that concerns us, we have calculated the 33<sup>rd</sup> and 66<sup>th</sup> percentiles in the column of the coverage indexes (it does not matter if it is in ratio mode or percentage mode because the results will be identical). The following results are obtained:  $P_{33} = 0.20$  and  $P_{66} = 0.33$ . With these results, we can establish a first prioritization of needs, taking the two cut-off values of 0.20 and 0.33 and classifying them as follows:

- a) *Low priority* group, needs with IDen  $< 0.20$  ( $< P_{33}$ );
- b) *Moderate priority* group, needs with IDen between 0.20 and 0.33 (between  $P_{33}$  and  $P_{66}$ ); and
- c) *High priority* group, needs with IDen  $> 0.33$  ( $> P_{66}$ ).

With these assigning criteria, the needs will be classified and therefore hierarchical in three priority groups, namely,

**Table 3-** Classification of each socio-environmental need in priority groups according to their location in the percentiles considered ( $P_{33}$  and  $P_{66}$ )

Code	NEEDS	Priority group: 1: low; 2: moderate; 3: high
1	Initiate an EA project on ecological teaching gardens for people with visual and/or auditory disabilities to facilitate their integration and the acquisition of knowledge.	2
2	Carry out an EA project on ecological teaching gardens for the entire population to raise awareness with this group.	3
3	Carry out an EA project on an ecological teaching garden in the Centre.	2
4	Create a project on organic gardens to instil participants with a general idea of organic farming.	2
5	Take advantage of available spaces with the creation of an ecological teaching garden.	1
6	Adapt certain spaces in the Centre with the appropriate signage to encourage the independent movement of visually impaired visitors.	3
7	Ensure that participants know the difference between ecological and non-ecological products.	1
8	Adapt the pedagogical project to people with visual or hearing disabilities.	2
9	Promote the use of ecological agriculture among the participants through activities, information sessions, etc.	2
10	Adequate training and knowledge on the part of the Centre's pedagogical team on visual and auditory disability to provide an adequate response to their needs.	2

11	Respond to the specific educational-support needs (LOE, 2006) of these groups from the Centre's pedagogical project.	1
12	Adapt didactic materials such as booklets, guides, etc., to Braille for blind people or increase the size of the letters for people with poor vision.	1
13	Carry out activities parallel to the project, but intimately related to it.	2
14	Offer prior information sessions, explanations, etc., on organic farming.	2
15	Ensure that the stay in the Centre for participation in the project does not exceed 3-4 days.	3
16	Ensure that the groups that attend are heterogeneous for the integration of people with auditory-visual disability.	3
17	Engage in meticulous and detailed project planning.	1
18	Ensure that the project is carried out in the spring months.	3
19	Ensure that the price of the stay does not exceed approximately 150 euros.	2
20	Use appropriate materials for garden-related tasks.	1
21	Carry out a high-quality campaign to disseminate the project.	1

Source: Own elaboration.

### The prioritization of needs from the matrix of presences vs. absences

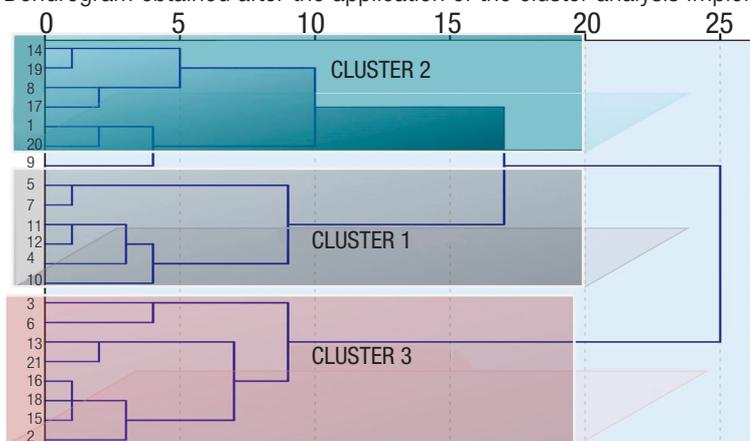
Another alternative for the prioritization of needs is an analysis of the map of the matrix of the presence vs. the absence of needs. Taking its binary arrangement as 0 = absence and 1 = presence, an ideal method to address its few execution restrictions is called cluster analysis. In our case, we have implemented the hierarchical cluster analysis using the Ward method and taking the quadratic Euclidean distances as dissimilarity measures. The main results after its implementation, the tree diagram (dendrogram) and the membership table are shown below. However, before assigning each need to a type of priority cluster, we must calculate its coverage index averages at the ratio and percentage level based on the cluster table initially provided by the inferred model. Once the initial structure of belonging for each need to its corresponding cluster is known, the averages are calculated at the ratio and percentage level with the objective of assigning each need with the same classification used in the percentiles; in other words, we identify the lowest averages with low priority and vice versa.

**Table 4-** Clusters, according to priority and complementary statistics

Cluster types, according to priority	Original membership cluster	Number of needs in the cluster	Needs that make up the cluster	Averages of coverage index	Average% coverage index
cluster 1: low priority	3	6	4,5,7,10,11,12	.2167	21.67%
cluster 2: moderate priority	1	7	1,8,9,14,17,19,	.2814	28.14%
cluster 3: high priority	2	8	2,3,6,13,15,16,18,21	.4763	47.63%

Source: Own Elaboration.

**Graphic 1-** Dendrogram obtained after the application of the cluster analysis implemented



Source: Own elaboration.

### Agreement between coverage indices vs. presence vs. absence matrix

The prioritization process can achieve a better legitimacy if we ultimately use a last point of analytical triangulation with two levels (coverage indexes vs. coverage map). To do so, it is essential to create a table in which we specify the place occupied by each need according to one strategy or another. The following table could be useful for such purposes:

**Table 5-** Classification correspondence of socio-environmental needs, according to coverage index and needs map (clusters)

NEEDS	Priority groups by coverage indexes (percentiles)	Priority groups by clusters
1	2	2
2	3	3
3	2	3
4	2	1
5	1	1
6	3	3
7	1	1
8	2	2
9	2	2
10	2	1
11	1	1
12	1	1
13	2	3
14	2	2
15	3	3
16	3	3
17	1	2
18	3	3
19	2	2
20	1	2
21	1	3

Legend: Group 1: low priority; 2: moderate priority; 3: high priority.

Source: Own elaboration.

To determine the number of agreements and disagreements, we have transformed the above table into a 3x3 two-dimensional contingency table, which we explain below considering the coverage and cluster index dimensions.

**Table 6-** Contingency table when comparing the classifications of the coverage indices and the cluster analysis

Coverage indices x cluster analysis		Coverage map: Cluster analysis			Σ
		Cluster 1: low priority	Cluster 2: moderate priority	Cluster 3: high priority	
Priority index by percentiles	Low priority: below p33	4	2	1	7
	Moderate priority: p33-p66	2	5	2	9
	High priority: over p66	0	0	5	5
Σ		6	7	8	21

Source: Own elaboration.

As shown in the table above, the number of agreements amounts to 14 (diagonal of the table), whereas the disagreements amount to half (7). To assess whether this 66.6% agreement is significant and, furthermore, not random, we must obtain the value of Cohen’s Kappa coefficient and complementary statistics as follows:

**Table 7-** Cohen’s kappa value and complementary statistics

		Value	Asymp. Std. Error *	Approx. t**	Approx. Sig.
Measure of agreement	Kappa	.603	.151	3.355	.001
N of valid cases		21			

\* Assuming the alternative hypothesis.

\*\* Using the standard asymptotic error based on the null hypothesis.

Source: Own elaboration.

As seen, the classification agreement of the needs by analytical strategies can be considered satisfactory, given that 14 report agreement and half (7) disagreement. To assess whether the 66.6% agreement is significant and, moreover, not random, we must obtain the value of Cohen’s Kappa coefficient that amounts to  $\kappa = .603$ .

Based on this result, we can affirm that a consistent agreement has been established, which according to the classification of Landis and Koch (1977) can be considered moderate. Even so, the agreement process remains incomplete if we do not verify the rejection of the null hypothesis  $H_0: \kappa = 0$  with  $T = \kappa / \sigma_{\kappa} \cong N(0,1)$ . In this sense, we can observe how we have obtained a typical asymptotic error ( $\sigma_{\kappa} = .151$ ) that is associated with a statistically significant “T” value ( $t = 3.35$ ) ( $p \leq .05$ ), which is exactly associated with a  $p = .001$ .

Therefore, we reject the null hypothesis, and we can affirm that the agreement achieved in the manner in which both analysis strategies (percentiles vs. cluster analysis) prioritize the needs of the environmental facility is globally similar.

## Conclusions

From the results obtained, we can infer two types of conclusions. On the one hand, we make what we can call methodological findings, and on the other hand, we make findings that are strictly related to the object of diagnosis, in our case, the needs of the environmental facility related to the unavoidable task of implementing an intervention project for visitors with sensory impairment. In any case, both are clearly related and it is impossible to understand one without the other.

Of the first, that is, those of a strictly methodological nature, we must bear in mind that the basic objective of this work has been the diagnosis of needs from an actionable research perspective to prioritize the demands presented when beginning the multiple triangulation processes. However, the premise of the approach has been multiple methodological-analytical triangulation as convergence. We have attempted to bring together—from different prisms—the degree of concordance or agreement established in terms of its importance given the needs highlighted in the diagnosis prior to the intervention project.

In this sense, as seen from the agreement coefficient finally obtained ( $r = .603$ ), it can be said that an agreement has been established consisting of how different agents or participants and different information collection techniques have highlighted the needs that, in its opinion, were more important in an environmental facility. Consequently, this legitimates the hierarchy of needs established as useful for the intervention project put in place. We must not forget that in the qualitative methodology, one of the most powerful strategies to validate our conclusions is triangulation in its different typologies.

Until now, the problem has been that even though triangulation processes are used and there have been many research reports, only a few of those reports have presented totally combined results. That is, it is typical to conclude that there are watertight findings from the different levels and points of triangulation that are commented on and discussed separately. Thus, in our example, starting from three levels with two triangulation points ( $3N \times 2P$ ), we would obtain results  $A_1/A_2 + B_1/B_2 + C_1/C_2$  and, therefore, conclusions  $A_1/A_2 + B_1/B_2 + C_1/C_2$ . From this perspective, our proposal lies in obtaining combined results:  $A_{1/2} B_{1/2} C_{1/2}$  and consequently, conclusions:  $A_{1/2} B_{1/2} C_{1/2}$  intimately confronted in search of a possible or probable consensus.

Last but not least is to determine the degree to which the results obtained by the different views considered are similar, provided that the initial premise is both triangulation and convergence. In this sense, the triangulation model implemented will have greater validation power the greater the agreement reached.

Thus, even with all the limitations of this study, we can confirm that methodological triangulation is a useful tool to validate and legitimize results based on qualitative quality criteria such as confirmability, dependence...

Second, we find what we have called findings or conclusions related to the object and research objectives of the study. In this sense, we can affirm that there is a justified consensus that establishes three degrees of importance in which the 21 prioritized needs in this diagnosis are grouped in the following dimensions: there is a group of high priority needs that involve the importance of carrying out intervention projects related to gardens and their adaptation to spaces, resources and the timing of actions. We could call this high-priority group the *Adaptation of Socio-environmental Actions for the Sensory Disabled*.

However, there is a second level or group of needs of moderate priority related to the importance of developing actions on ecological teaching gardens to promote training, environmental awareness and knowledge of organic farming from processes adapted to the visually disabled group to encourage their integration. We could call this group the *Training and Awareness for the Sensory Disabled through Socio-environmental Actions*.

Finally, we find a group of low-priority needs that derive from the planning, execution and adaptation of the spaces and the intervention for the development of these socio-environmental initiatives. We could call this group of needs *Design and Planning of Socio-Environmental Actions for the Sensory Disabled*.

We can conclude, therefore, that to make feasible and develop relevant socio-environmental interventions in environmental education facilities, a good needs diagnosis is required that can be supported at a methodological level in processes involving the methodological-analytical triangulation of data that validate the demands derived from said process.

## References

ALVAREZ ROJO, Victor. **Diagnóstico pedagógico**. Archidona: Aljibe, 2002.

BACA, Laura; BOSKER, Judith. **Léxico de la política**. México D.F: Fondo de Cultura Económica, 2000.

BARUSCH, Amand et al. Rigor in qualitative social work research. A review of strategies used in published articles National Association of Social Workers (NASW). **Social Work Research**, Oxford, v. 35, n. 1, p. 11-19, 2011.

BEATTIE, Rona et al. **Utilizing methodological pluralism to develop theory**: analytical triangulation enhancing understanding of managerial effectiveness in supporting learning, United Kingdom: [s. n.], 2005. Disponible en: <<http://search.proquest.com/docview/62073797?accountid=14542>>. Acceso en: 28 my. 2008.

BEKHET, Abi; ZAUSZNIEWSKI, Jaclene Annette. Methodological triangulation: an approach to understanding data. **Nurse Researcher**, Ohio, v. 20, n. 2, p. 40-43, 2012.

BERICAT, Eduard. **La integración de los métodos cuantitativo y cualitativo en la investigación social**: significado y medida. Barcelona: Ariel, 1998.

BJURULF, Staffan et al. A triangulation approach to impact evaluation. **Evaluation**, New York, v. 19, n. 1, p. 56-73, 2013.

BOEIJE, Hennie. **Analysis in qualitative research**. London: Sage, 2009.

BROD, Meryl, TESLER, Laura; CHRISTENSEN, Torten. Qualitative research and content validity: developing best practices based on science and experience. **Quality of Life Research**, Amsterdam, v. 18, n. 9, p.1263-1278, 2009.

BROWN, Judith et al. Measuring teamwork in primary care: triangulation of qualitative and quantitative data. **Families Systems & Health**, Washington, DC., v. 33, n. 3, p. 193-202, 2015.

BUSTAMANTE, Jorge. **Derecho ambiental: fundamentación y normativas**. Buenos Aires: Hacedlo-Perrot, 1995.

CABANILLAS, Antonio. **La reparación de los daños al medio ambiente**. Madrid: Aranzadi, 1996.

CAMPBELL, Donald; FISKE, Donald. Convergent and discriminant validity multitrait-multimethod matrix. **Psychological Bulletin**, Washington, DC., v. 56, n. 2, p. 81-105, 1959.

COHEN, Louis; MANION, Louis. **Métodos de investigación educativa**. Madrid: La Muralla, 2002.

CRESWELL, John. **Research design: qualitative, quantitative and mixed methods approaches**. Thousand Oaks: Sage, 2005.

DENZIN, Norman. Moments, mixed methods, and paradigm dialogs. **Qualitative Inquiry**, New York, v. 16, n. 6, p. 419-427, 2010.

DENZIN, Norman. **The research act**. New York: McGraw-Hill, 1978.

ERAZO, María Soledad. Rigor científico en las prácticas de investigación cualitativa. **Ciencia, Docencia y Tecnología**, Ente Ríos, v. 22, n. 42, p. 107-137, mayo, 2011.

ESPAÑA. LOE - Ley Orgánica 2/2006, de 3 de mayo, de Educación. **Boletín Oficial del Estado**, Madrid, n. 106, p. 17158-17207, 4 mayo 2006.

FLICK, Udo. **Triangulation**. Weinheim: Deutscher Studien Verlag, 2005.

GIBSON, Will. **Working with qualitative research**. London: Sage, 2009.

GIBSS, Graham. **El análisis de datos cualitativos en investigación cualitativa**. Madrid: Morata, 2012.

GORISSEN Pierre et al. Analysing students' use of recorded lectures through methodological triangulation. In: UDEN, Lorna et al. (Ed.). **WORKSHOP ON LEARNING TECHNOLOGY FOR EDUCATION IN CLOUD (LTEC'12)**, 2012, Berlin. **Advances in intelligent systems and computing**. v. 173. Berlín: Springer, 2012. p. 145-156.

GRACIA, Paloma et al. Ve escuchando, escucha viendo: el huerto de los sentidos. In: TOJAR-HURTADO, Juan Carlos (Coord.). **La formación de educadores ambientales a nivel Máster: propuestas profesionales y trabajos de investigación**. Archidona: Aljibe, 2013. p. 127-144.

HIND, Daniel. Using a logic model and a triangulation protocol for integrating quantitative and qualitative research data in a mixed-methods feasibility study incorporating an external pilot RCT. **Trials**, New York, v. 18, n. 1, p. 46-67, 2017.

JICK, Todd. Mixing qualitative and quantitative methods: triangulation in action. **Administrative Science Quarterly**, Cornell, v. 24, n. 4, p. 602-611, 1979.

LANDIS, Richard; KOCH, Gary. The measurement of observer agreement for categorical data. **Biometrics**, Hoboken, v. 33, p. 159-174, 1977.

LÓPEZ, Andrea, et al. Interdisciplinary mixed methods research with structurally vulnerable populations: case studies of injection drug users in San Francisco. **International Journal of Drug Policy**, London, v. 24, n. 2, p. 101-109, 2013.

MILES, Matthew; HUBERMAN, Michael. Data management and analysis methods. In: DENZIN, Norman; LINCOLN, Yvona (Ed.). **Handbook of qualitative research**. London: Sage, 1994. p. 429-444.

MORAL, Cristina. Criterios de calidad de la investigación cualitativa. **Revista de Investigación Educativa**, Murcia, v. 24, n. 1, p. 147-166, 2006.

MORSE, Janice. Insight, inference, evidence, and verification: creating a legitimate discipline. **International Journal of Qualitative Methods**, Edmonton, v. 5, n. 1, p. 1-7, 2006. Disponible en: <[http://www.ualberta.ca/~iiqm/backissues/5\\_1/html/morse.htm](http://www.ualberta.ca/~iiqm/backissues/5_1/html/morse.htm)>. Acceso en: 11 jun. 2010.

NEWMAN, Isadore et al. Content validity using a mixed methods approach: its application and development through the use of a table of specifications methodology. **Journal of Mixed Methods Research**, Ann Arbor, v. 7, n. 3, p. 243-260, 2013.

OELINIK, Anton. On content analysis of images of mass protests: a case of data triangulation. **Quality & Quantity**, Amsterdam, v. 49, n. 5, p. 2203-2220, 2015.

OKOE, Abednego Feehi; BOATENG, Henry. Two-way communication on bank websites in Ghana: a data triangulation approach. **Information Development**, New York, v. 32, n. 5, p. 1471-1484, 2016.

PEREIRO, María Delia. **Daño ambiental en el medio ambiente urbano: un nuevo fenómeno económico en el siglo XXI**. Buenos Aires: Fondo Editorial de Derecho y Economía, 2001.

RAE. Real Academia de la Lengua Española. **Diccionario de la Lengua Española**. Madrid: Espasa Calpe, 2002.

REBORATTI, Carlos. **Ambiente y sociedad: conceptos y relaciones**. Buenos Aires: Ariel, 2000.

RICHARDSON, Laurel. **Fields of play: constructing an academic life**. New Brunswick: Rutgers University Press, 1997.

RODRÍGUEZ, Gregorio et al. **Metodología de la investigación cualitativa**. Archidona: Aljibe, 1999.

RODRÍGUEZ-SABIOTE, Clemente et al. La triangulación analítica como recurso para la validación de estudios de encuesta recurrentes e investigaciones de réplica en Educación Superior. **Revista de Investigación y Evaluación Educativa**, Valencia, v. 12, n. 2, p. 1-18, 2006.

RODRÍGUEZ-SABIOTE, Clemente; GUTIÉRREZ-PÉREZ, José. Un modelo de validación de estudios empíricos en investigación educativa mediante procedimientos de triangulación: aplicación a un estudio de caso sobre disfunciones y desajustes asociados a la reforma de un plan de estudios universitario. **Revista Portuguesa de Pedagogía**, Coimbra, n. 39, p. 135-157, 2005.

RODRÍGUEZ-SABIOTE, Clemente; LORENZO-QUILES, Oswaldo. Teoría y práctica del análisis de datos cualitativos: proceso general y criterios de calidad. **Sociotam**, Ciudad Victoria, v. 15, n. 2, p. 133-154, 2005.

RUIZ OLABUÉNAGA, José Ignacio. **Teoría y Práctica de la Investigación cualitativa**. Bilbao: Universidad de Deusto, 2012.

SALDAÑA, Johnny. **The coding manual for qualitative researchers**. Thousand Oaks: Sage, 2013.

SANDÍN, Mari Paz. El rigor científico en la investigación cualitativa. **Revista de Investigación Educativa**, Murcia, v. 18, n. 1, p. 223-242, 2000.

SCHRAELI, Marianne et al. Interprofessional collaboration from nurses and physicians: a triangulation of quantitative and qualitative data. **Pflege**, Göttingen, v. 30, n. 2, p. 53-63, 2017.

STUTZ, Ulrike. Art and science: an empirically grounded construction of types through interdisciplinary data triangulation of pictures and texts in an ethnomethodological research in early childhood art education. **International Journal of Qualitative Methods**, Edmonton, v. 15, n. 1, p. 1-8, 2016.

TEIXEIRA, Juliana Cristina et al. Triangulation method in administration studies: generating conversations between paradigms or mere “convergent” validations? **Revista de Administração Pública**, Rio de Janeiro, v. 46, n. 1, p. 191-220, 2012.

TÓJAR, Juan Carlos. **Investigación cualitativa: comprender y actuar**. Madrid: La Muralla, 2006.

TORRANCE, Harry. Triangulation, respondent validation, and democratic participation in mixed methods research. **Journal of Mixed Methods Research**, Ann Arbor, v. 6, n. 2, p. 111-123, 2012.

VAN DRIE, Jannet; DEKKER, Rikje. Theoretical triangulation as an approach for revealing the complexity of a classroom discussion. **British Educational Research Journal**, London, v. 39, n. 2, p. 338-360, 2013.

YEASMIN, Sabina; FERDOUSOUR, Khan Rahman. Triangulation research method as the tool of social science research. **BUP Journal**, Bristol, v. 1, n. 1, p. 154-163, 2012.

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