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ASSESSING THE SUITABILITY OF SCHOOL SURROUNDINGS FOR CHILDREN'S MOBILITY USING A PARTICIPATORY MULTI-CRITERIA APPROACH: THE CASE OF A PRIMARY SCHOOL IN GUELMA, ALGERIA

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ABSTRACT

The surroundings of the school are sensitive spaces that play an integral role in the sustainability of children's mobility on their journeys to school. Indeed, this vulnerable category is in daily interaction with an urban environment that must be friendly and suitable. This work is based on the synthetic criteria and indicators of UNICEF and Its agencies, which are appropriate for the children's needs. The study presented here will evaluate the suitability of the school surroundings for children's mobility through a participatory multi-criteria analysis that focuses on the child as an inseparable actor in the analysis process. The case study for this field of investigation is a primary school located in the centre of Guelma, a city in the Northeast of Algeria. A survey questionnaire was conducted to collect quantitative and qualitative data on their experience of mobility, from a sample of 169 pupils (5 to 12 years old). The synthetic criteria were weighted by frequency analysis using SPSS according to the surveyed population. The data shows that 23 % of the participants ranked the stability of the social structure criterion in the first position. The suitability of multi-criteria approach will be tested by applying it to the synthetic criteria ranked first. The results show that the majority of social indices with a direct influence on children's mobility have negative performance values, synonymous with non-suitability. Other indicators have low values of positive performance, synonymous with an average suitability level, which still needs to be improved. Overall, this participatory multi-criteria analysis shows that the school environments studied do not satisfactorily meet the safety and well-being requirements that are essential for sustainable school mobility adapted to children's needs.

KEYWORDS

Participatory Multi-Criteria Analysis, Children's Mobility, Home-School Journey, School Surroundings, Primary School, Guelma City

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Introduction.

Scientific researchers are increasingly interested in issues related to the relationship of the child and its social development in the urban context. Moreover, the healthy and serene growth of children is a major challenge for the social, economic and environmental development of a country and their integration into the planning process is a key step (Özdemir, 2019). In this light, UN agencies and their partners, such as UNICEF (United Nations Children's Fund) and UNESCO (United Nations Educational, Scientific and Cultural Organization), among others, have adopted a common vision, emphasizing that the child seems to be the missing link in urban planning and that "if we can build a successful city for children, we will have a successful city for all people" (Aerts, 2018).

Nowadays, more than one billion children live in cities (UNICEF, 2012). For this reason, the quality of outdoor spaces must be high performing and adequate to provide a climate of sustainability and resilience for their users (Voce, 2018), including vulnerable persons. Spatially, children's interactions are occurring in an activity space encompassing home, school and a 'third place' (Babb et al., 2017), which provides a link between them. Unfortunately, children often find themselves in the most disadvantaged situations because the built environment is designed and constructed by and for adults to meet the demands of their daily lives.

The benefits of urban living escape children, while its negative aspects can severely affect them (Aerts, 2018). In parallel, the Western Australian Commissioner for Children and Young People suggests that neighbourhood design should include safe and connective spaces and streets, with accessible and legible pathways that ensure walkability and cyclability for children and young people (CCYP-WA, 2011). In terms of health, physical inactivity among children has led to a global phenomenon of overweight and obesity and other childhood diseases (Lee, 2020; WHO, 2022). There are numerous researchers who state that in order to have stable child growth, it is necessary for children to concretely exercise this space where they need to: socialise, move, have autonomy and actually interact, to allow cognitive and relational development (Garau, Annunziata, et al., 2024).

In this sense, a child's journey to school is considered one of the first experiences in which he or she is directly confronted with urban realities. In the context of mobility, the school environment's performance cannot be understood in an unilateral way, as various factors influence the mode of travel. It has been reported that peak hours are now reaching two to three hours, and congestion is becoming a recurring phenomenon in daily life, in the morning, at noon, in the evening and on weekends (Jayasooriya and Bandara, 2017). In a way, a not insignificant number of studies state that unplanned land use leads to traffic congestion (Ali, Adnan, et al., 2014). On the other hand, poor public transportation planning and inequitable distribution of school resources have worsened the situation of school surroundings (Zhang, Yao, et al., 2017). As a result, parents often experience intense anxiety about their children's insecurity (Lamari and Lazri, 2021). This phenomenon also leads to accompanying practices to go to school or the park with young children and vice versa (Kaufmann and Widmer, 2005).

Currently, children's well-being has become a key indicator (Ben-Arieh, Kaufman, et al., 2001), which can be demonstrated through educational activities, that should focus on sustainability and resilience as a process that guarantees a better future for new generations. In this sense, a number of actions and initiatives have been launched with the aim of ensuring a suitable and welcoming educational space for children. Starting with UNICEF's Child Friendly Cities initiative in 1996, a series of initiatives have also emerged to educate and raise awareness among schoolchildren about active travel, traffic moderation and sustainability, such as the 'living street' that emerged in the Netherlands, the 'zone 30' directive that emerged in France in 1990, and the zero-emission bus in the United Arab Emirates ... etc. (Aerts, 2018).

Therefore, every child has the right to participate in an appropriate manner and to have his or her views taken into account in all matters that concern him or her, in modalities that are appropriate to the child's age and development (UNICEF, 2012). Also, as an example, the concept of "place-based", which has been proposed as a pedagogical tool to improve the relationship of schoolchildren with their immediate environment in a holistic approach (Gruenewald and Smith, 2007). Currently, the challenges confronted have been diagnosed and resolved through a systematic process based on the integration of ICT as well as the collection and analysis of data, whose governance is exercised in a climate of transparency and accountability to individuals (Bertot, Jaeger, et al., 2010).

Algeria, a developing country, is struggling to have one or more updated tools for designing and evaluating the school environment in accordance with current universal standards relating to children, especially for the old schools built after the school explosion (International Institute for Educational Planning, 1977) to respond to a quantified need through urgent actions that are not rigorously planned (Rebouha and

Pochet, 2011). Today, these establishments are in restrictive conditions that are unsuitable for children, particularly in terms of their urban implantation and the neglect of school zone planning.

Algeria recently had 4,669,417 primary school pupils (Bazizi, 2021). These pupils travel to and from school in extremely unequal conditions that vary from one region to another; children in the Saharan region, those in rural areas and those in urban centres do not share the same daily experience. At local level, primary schools in Guelma city account for 69% of educational establishments in the Wilaya , where the number of pupils reached 5,830 in 2019 (Bazizi, 2021). They are confronted with mostly inappropriate urban conditions that restrict their use and mobility.

The aim of this research is to test whether our methodological process can be used as a decision-support tool and to assess the suitability for children of the surroundings of an urban school represented by the case study. This is carried out using a participatory multi-criteria methodological approach based on UNICEF standards for Child-Friendly design. This method of analysis is centered on a participatory approach, placing the child at the forefront of the issue. This research contributes to informing and raising the awareness of children as promoters of sustainable development through health, wellbeing and social development that can be achieved through walking to school.

Theoretical Framework

Promoting children's scientific research using a multi-criteria approach

According to previous studies, the relationship between the child and its external environment at different scales cannot be assessed unilaterally. This is due to the complexity of this systemic relationship. By resorting to multi-criteria analysis, Agenda 21 emphasizes the need to develop criteria and methodologies for assessing impacts (United Nations Conference on Environment and Development Rio de Janerio, Brazil, 3 to 14 June 1992 - AGENDA 21, 1992). Consequently, several experiments have been conducted based on well selected criteria to assess the reality of urban life (Hadji, 2012; Matusiewicz, 2020; Purwohandoyo, Reinhart, et al., 2023). In the field of children, UNICEF has introduced the "Child Friendly Cities" initiative at the end of the 20th century, which can refer to anything aligned with children's rights and ensures that their needs and priorities are integrated into various aspects: spatial planning, policies and decision-making mechanisms, and even the little actions of their daily lives (UNICEF, 2022). Since this launch, a number of studies have emerged incorporating child-friendly notion as criteria and indicators for assessing various contexts such as the built environment (Choi and Kim, 2019; Jahromi, 2020; Mousavi, Jahangirzadeh, et al., 2023). Other studies have focused on the legal context of children in order to verify whether regulatory texts are aligned with children's rights, or whether the legal aspect is implemented and integrates the child as an actor in order to have a space adapted to children (Novella-Cámara, Romero-Pérez, et al., 2021; Sutiamah, Ravena, et al., 2022).

On a different scale, concerning schools facilities, scientific research based on multi-criteria analyses is usually carried out to assess the indoor environment of the school property (Kim and Ryu, 2017; Nafisa, Syaom Barliana, et al., 2022). While the external environment of the school has been taken into account according to several aspects of the home-school journey dealing with the child's behaviour (Asrun, Said, et al., 2020; Fares and Bougdah, 2023), mobility and walkability (Ahmadi and Taniguchi, 2007), health (Evenson, Neelon, et al., 2008), physical components (Lamari and Lazri, 2023; Nordbø, Nordh, et al., 2020; Bechaa, Dahmani, et al., 2024) and their repercussions on the reality experienced by pupils. However, studies focusing on schools' surroundings are still few in number. It is therefore essential to step up scientific research into these sensitive areas. Especially with the availability of sustainable international guides and standards (Aerts, 2018) that can be used as theoretical sources.

The place of the child in urban challenges

Shaping an urban life adapted to the needs of children and young people through active and participatory planning processes is the fruit of a long journey that began with the observation that cities were not meeting the needs of vulnerable users. Consequently, the enunciation of the Convention on the Rights of the Child in 1989 and the child-friendly cities initiative launched by UNICEF in 1996 were actions to remedy the situation (Hadfield-Hill, 2019). The actions were numerous, but the objective was single and embodied in the principle of "leave no one behind" (United Nations Sustainable Development Group, 2019).

Children's issues in the context of sustainable cities are becoming major challenges at global, city and community levels, attracting the interest of a wide range of researchers. Their well-being is influenced by the spaces they are interacting with. The determinants of children's well-being are multiple: social interactions, economic and political structures as well as physical features (Gencer and KARAGÖZ, 2017). The physical environment that children interact with play an integral part in their growth and healthy development (Bao et

al., 2021). It is noted that child-friendly planning in cities could help in achieving urban goals and addressing urban challenges through the reinforcement of links across the built environment, the public realm and children's wellbeing (Frost and Klein, 1979).

Children develop their skills and their knowledge of concepts relating to their surroundings.These evolve further when they are exposed to the school environment (Sulaiman and Ibrahim, 2019). The child's behaviour reflects the degree of suitability of tangible and intangible conditions around him. In the context of the schools' surroundings which cover the immediate area around the school buildings, a pupil's correct behaviour in this area stems from a safe and transparent environment and an adequate quality of life. In physical terms, it means having spaces that include urban rights such as accessible and resilient facilities, child friendly outdoor areas (playgrounds, sports fields, car parks, urban furniture…) as well as safe sidewalks and streets… (Jacobs, 1992) that integrate the notion of sustainability. Then, the social suitability of these urban spaces is achieved by putting people first and focusing on their quality of life (Wright, Williams, et al., 2017) and by taking into consideration their opinions (Vilhelmson, Johnston, et al., 1995).Generally, welcoming urban space is an area where social, economic, political, cultural and environmental rights are in balance, in a way that involves children in the decision-making process and allows them to express their needs as representatives of future generations (Wilhelmsen, Øvreås, et al., 2023).

The theoretical framework used in this research has enabled us to establish a database containing objectives initially taken from major institutions (UNICEF and its agencies) including scientific research. These objectives, which are consistent with the Sustainable Development Goals (SDGs) and international agendas, have been adapted and contextualised to respond specifically to the challenges of schoolchildren's mobility. They have been reformulated in the form of criteria and indicators, established according to a hierarchical multi-criteria approach. The following table details the origin of each objective, which will then be used as an indicator in the evaluation process.

Table. 1. The source of each objective used in the participatory multi-criteria evaluation related to children's mobility on the school's surroundings.

Objective	Indicators	Source of information
- Training and educating in children's rights and urban planning. - Training on risk assessment, such as how to cross the road safely or drive responsibly. - Educating on environmental sustainability and civic engagement. - Generating emergency preparedness actions for children to reduce the risk of disasters.	Training and awareness	(Aerts, 2018; UNICEF, n.d.) (UNICEF, 2013)
- Correlate the built environment with children's well-being through improving children's use, comfort and stimulation.	Comfort and well-being	(Aerts, 2018; Ben-Arieh, Kaufman, et al., 2001; Semerci and Erdoğan, 2015)
- Create an equitable environment. - Improve equity in access to basic services for children (transport, mobility and facilities), including children with disabilities. - Address social equity concerns for children.	Equity and citizenship	(Aerts, 2018; UNICEF, 2008; Winder and Yablonski, 2012)
- Encouraging social interaction. - Enhancing the principle of social mix.	Social Mixing and Perception	(Aerts, 2018)
- Commit to guaranteeing children's rights to survival and healthy development. - Children need adequate living space. - Improve the situation of children in vulnerable situations (low-income families and children with disabilities)	Socio-economic factors	(Semerci and Erdoğan, 2015; United Nations, n.d.)
- Make appropriate use of surveillance measures for children.	The existence of a surveillance system	(Feldstein, 2020)
- Ensuring safety from human-induced hazards (conflict, violence, accidents, abuse, neglect, etc.)	Social safety	(Aerts, 2018; Pattnaik, 2019; Semerci and Erdoğan, 2015)
- Providing safe spaces for children and especially pedestrians.	Road safety	(Aerts, 2018; Semerci and Erdoğan, 2015)
- Contribute to promoting a cleaner, healthier environment for children.	Indicator of Hygiene and Health Safety Education	(Aerts, 2018; Semerci and Erdoğan, 2015; UNICEF and WHO, 2018)

- Take preventive measures to protect children from fires around the school by means of safety devices and evacuation plans	Perception of danger and fire prevention measures	(Aerts, 2018; Pattnaik, 2019)
- Ensuring the safety of schoolchildren around the surrounding area by protecting them from the various threats (natural hazards) to which they are exposed.	Prevention of natural disasters	(Aerts, 2018; Pattnaik, 2019)

Source: own elaboration based on different sources.

Table 1 lists the objectives, the majority of which are taken from recent UNICEF documents that provide detailed definitions and justifications for each. Although these sources do not explicitly mention the context of children's mobility around schools in some cases, the urban nature of this space, integrated into the fabric of the city, highlights its relevance to the evaluation. Child, the key actor of school mobility, spend most of his or her day at school (Pattnaik, 2019) passing through its surroundings, which justifies and strengthens the methodological basis for evaluating such a context.

Methodological Approach

Evaluating children's mobility around schools

The present investigation is based on synthetic criteria and indicators developed by UNICEF and its agencies, which are appropriate for the needs of the child. These criteria have been contextualised and adapted in order to assess the suitability of the school environment for children's mobility in the areas surrounding schools, particularly given the lack of specific decision-making tools at local level.

Table 2 presents an extract from the summary table of the performance criteria relating to children's mobility for school environments, which have been grouped under seven (07) main rubrics, incorporating a wide range of urban parameters to analyse the conditions that promote a school environment adapted to children's mobility, such as: Stable social structure, economic efficiency and service adequacy, Suitability of transport services and sustainable mobility, suitability of the built environment, environmental sustainability and resource systems, local governance and decision-making mechanisms, integrating new ICTs into planning and cartography.

From each synthetic criterion, a number of indicators were derived to evaluate the performance of each criterion in a rigorous and exhaustive way. Sometimes, the multiplicity of indicators forced us to split the main synthetic criterion into two criteria in order to facilitate the evaluation. On the other hand, to respect the balance between the categories and to be more exhaustive. For example, the synthetic criterion of the stability of the social structure is divided into two parts (Table 2):

a - Criterion of quality of life and integration of the child.

b - Criterion of security and safety of the child around the school.

Table. 2. Extracted from the Summary Table of school surroundings criteria and indicators.

Synthetic Criteria		**Evaluation Indicator**
Stable Social Structure for Children	Quality of Life and Integration of the Child	- Indicator 01: Training and awareness in road safety and first-aid, in sustainability and sustainable mobility, in spatial awareness, children's rights and civic education.
		- Indicator 02: Comfort and well-being (physical, mental, social).
		- Indicator 03: Equity and citizenship.
		- Indicator 04: Social Mixing and Perception.
		- Indicator 05: Socio-economic factors (age, gender, economic status...).
	Security and Safety of the Child Around School	- Indicator 06: The existence of a surveillance system such as pedagogical radars, surveillance cameras...
		- Indicator 07: Social safety.
		- Indicator 08: Road safety.
		- Indicator 09: Indicator of Hygiene and Health Safety Education (cleanliness, sanitation, and water supply standards).
		- Indicator 10: Perception of danger and fire prevention measures.
		- Indicator 11: Prevention of natural disasters (high winds, earthquakes, sand tornado in Saharan areas...).

Source: Authors.

The methodological process is summarized in 6 steps (Figure 1) structured as a top-down approach as follows:

- Weighting phase of the synthetic criteria (SCx): The synthetic criteria (SCx) are weighted by means of a survey carried out in situ with schoolchildren, with the help of their parents. Through a frequency analysis, each synthetic criterion will have a percentage according to the priority indicated by the pupils as main users.

To make the synthetic criteria measurable, their indicators must be converted into quantities through a scoring system:

- Relevance Notation (N_R): For each indicator, a score is assigned according to its degree of relevance (1= not very relevant, 2= relevant, 3= very relevant) to the local documents.
- Expert Evaluator Notation (N_{EX}): Due to the limited knowledge of the children and their parents, and in order to obtain accurate and fair results, the expert evaluators rank the indicators of each series (each ranking is synonymous with a precise score according to the degree of importance of each indicator) using a simple, impartial method, called the outranking method. In our case, the researchers, as expert evaluators, consider that the sum for each series of indicators is equal to 10.
- Subjective notation system of school approaches (N_S): by a notation system of 1, 2 and 3, successively to a low performance (not adapted to the child's mobility), an average performance (moderately adapted to the child's mobility) and an adequate performance (very adapted to the child's mobility). Each pupil, with the help of his/her parents, will assign a score for each indicator according to the reality of his/her daily life. We will take into account the most chosen score by the surveyed children.
- Then, the performance will be obtained by applying the Weight Score Value method WSM to determine the index value of the synthetic indicator (VI. Sx).
- Standardisation of the index values (Z_{Sc}): since the units of the synthetic criteria are heterogeneous, they could not be assigned the same threshold of the indices to be able to compare and analyse them. In this sense, it is recommended to standardise them by converting the raw values into normalised values using the Z-score (Cheniki, Baziz, et al., 2020) using the formula of Hervé Abdi (2007). It should be noted that this calculation process has already been used to assess the quality of a public space (Hadji, 2012). It was adopted and contextualised according to the objectives of our research. A normalisation step was added to standardise the values obtained (Z_{Sc}) using Hervé Abdi's Z-score formula (Hervé, 2007).

The sum will give the global index value (VI) of the synthetic criteria by calculating the average of the weighted and standardised values of the indicators. The results are then presented in graphs to facilitate their interpretation.

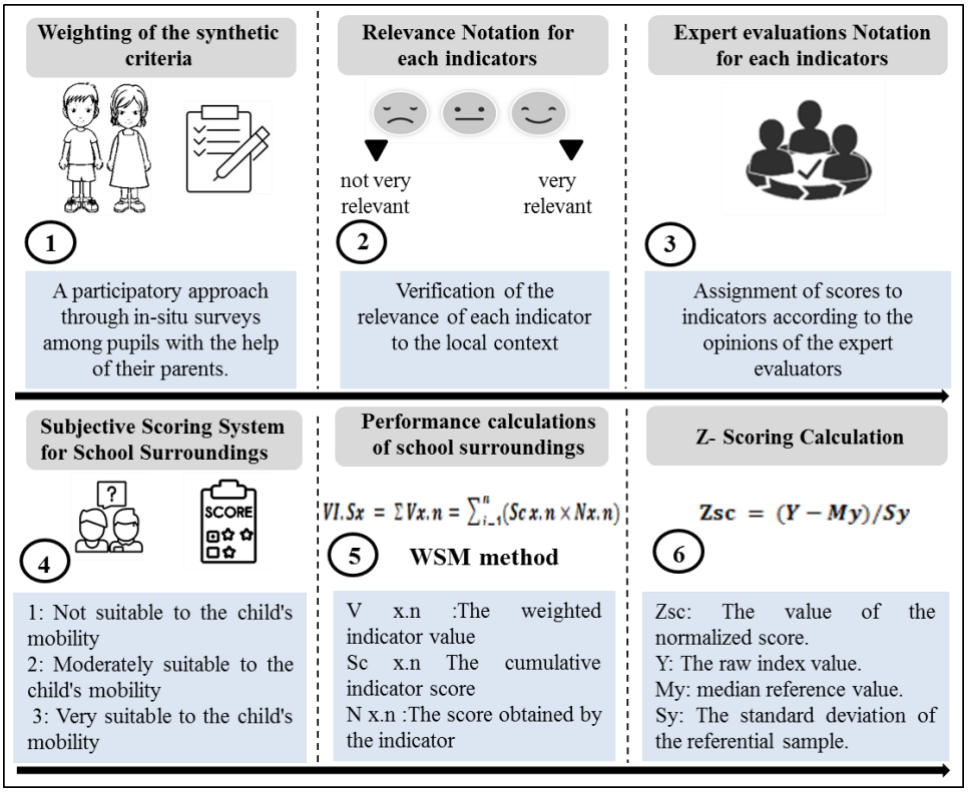

Fig. 1. Participatory Multi-Criteria Evaluation Process.
Source: own elaboration based on different sources.

Study context:

The methodological approach described in the preceding sections was applied to an urban school, located in Guelma, Algeria (36° 27'43 N; 7° 25'33 E; 840 m altitude). The school was chosen because of its location in the city center and near the main traffic axes (Figure 2).

In this urban context, the external surroundings of the school can be limited to a relatively small area comprising the nearby buildings, streets, crossroads, and sidewalks that form the immediate physical environment. It is important to note that the spatial extent of the school environment is not easily defined, as it is also strongly influenced by both the internal and external urban phenomena of it perimeter such as traffic flow, pedestrian flow, the nature of surrounding activities, and the characteristics of the architectural space, etc.

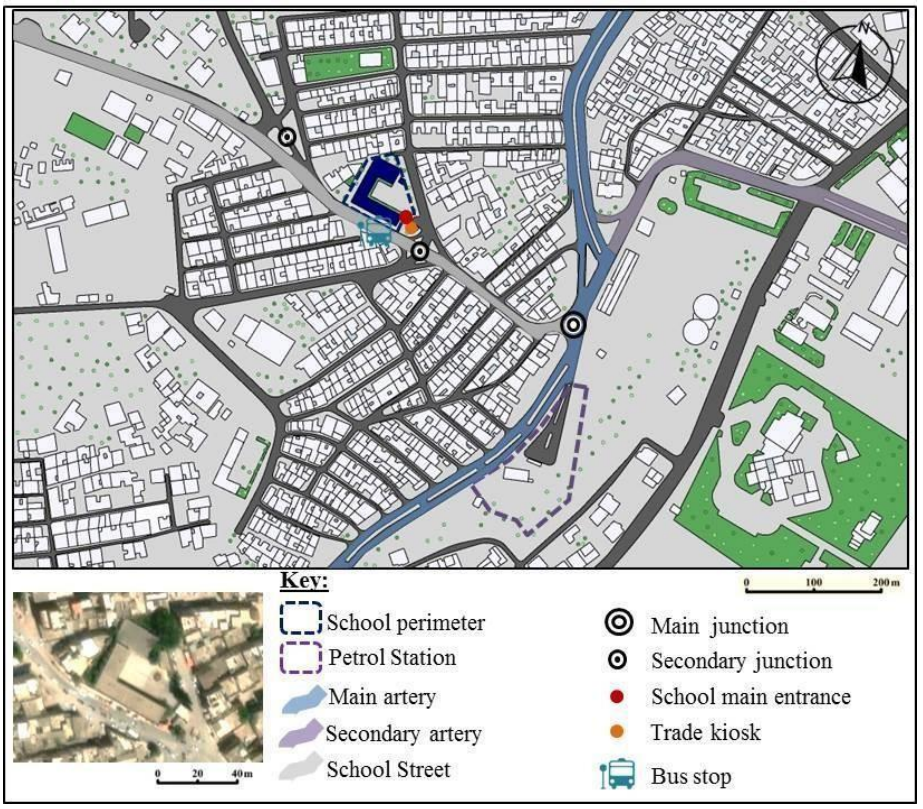

Fig. 2. Location of the School within the City.
Source: Authors.

The school environment is characterized by:

- A huge potential traffic conflict due to the proximity of the school to the main artery. The existence of a petrol station some 200 meters away adds to the road traffic flow and makes the conditions worse. According to the revised study of the new transport plan of the city (CECOM-CIRTA and DTW Guelma, 2015) more than 16810 vehicles pass, each day, through the main boulevard junction at a distance of 200 m from the school (Figure 2).
- The presence of a small kiosk in front of the main entrance and an illegal street trade in the area around the school could harm the school's visibility.
- The poor location of the three (03) crossroads and two (02) bus stops near the main entrance of the school.
- The poor design of the bus stops and the passage of several public transport lines in front of the school's entrance.
- The presence of heavy good vehicles running past the school's main entrance.
- The lack of hygiene due to the poor management of waste from illegal trade.
- The lack of school signs and other shortcomings in child safety (lack of pedestrian crossings, road signs, etc.), making the journey to and from school more dangerous.
- The anxiety of parents who always accompany their children to school.

The integration of this school in its urban fabric has not obeyed any urban norms or rules, given the emergency nature of its construction, which has led to its random implantation. Furthermore, the neglect of school zone planning and the conditions mentioned above have exacerbated the problem of these areas, particularly for children. This reality is having a serious impact on the social, economic and environmental rights of children.

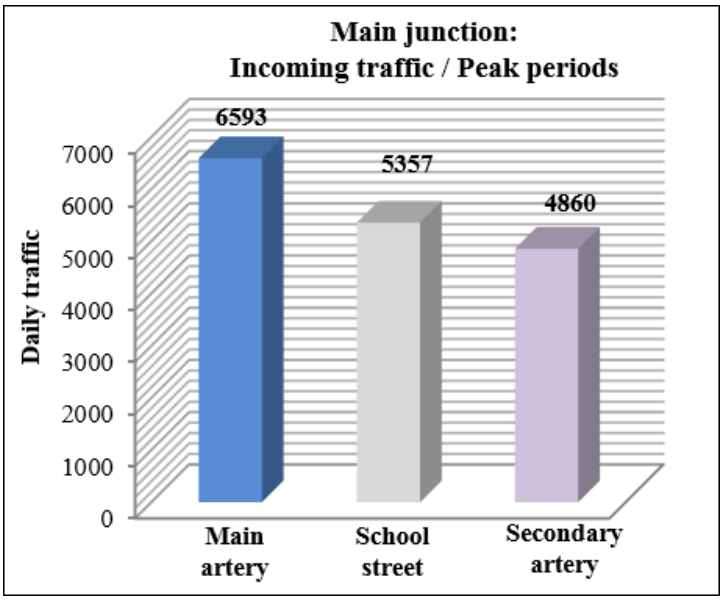

Fig. 3. Traffic flow for the main road intersection.
Source: Synthesis of Circulation Plan of Guelma City, 2015.

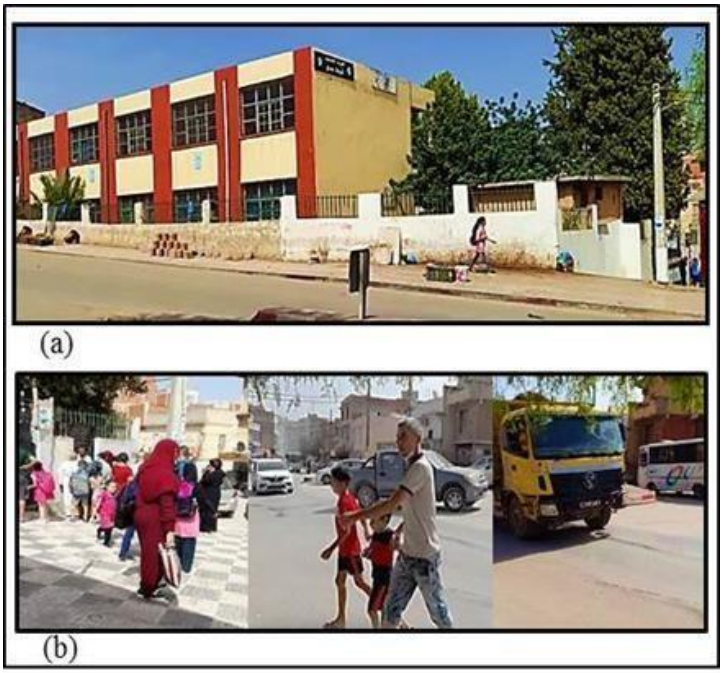

Fig. 4. (a) The School Building, (b) Some encountered problems.
Source: Authors.

Characteristics of survey sample:

According to UNICEF, a child is defined as any person under the age of eighteen (UNICEF, 2019). In our case, the study focuses on the category of children between the ages of 5 and 12, who are always going to

and from school and interact with the external environment in a different way. According to educational data, the school is attended by 49.03% girls and 50.97% boys, including 21.94 % of preparatory year pupils (Education Directorate of the Wilaya of Guelma, 2021a).

In the context of children's school mobility, and for assessing the performance of the school environment, a survey is carried out among a sample of pupils and their parents. The sample consists of 169 pupils with their parents (56.3% of schoolchildren with the help of their parents), 6% of whom are exceptional cases due to their disabilities and chronic diseases (autism, mental retardation, etc.).The survey plays an investigative and awareness-raising role for both pupils and their parents. It is accompanied by illustrations to facilitate the transmission of ideas to the pupils.

It should be noted that concepts that are beyond the reach of children's minds have been made clearer in the survey through the use of simple definitions and understandable illustrations. Teachers and social assistants were involved in explaining and simplifying the survey.

Results

As part of the study of children's mobility to school, we are using a participatory multi-criteria analysis to explore the social impact of the school environment, taking account of children as the main actors in their own mobility. This approach allows us to measure the suitability of the school environment for their mobility needs, using a flexible tool. More specifically, our aim was to examine how the surroundings of the school, containing urban phenomena and architectural deficiencies, affect children's mobility.

The collection of qualitative and quantitative information took considerable time (more than a month). The data had to be weighted to obtain performance results, which are explained below.

The synthetic criteria were weighted by frequency analysis (SPSS Statistics 22) according to the opinions of the sample of children population surveyed with the help of their parents. Each pupil ranked the criteria according to their own needs and lived reality.

The ranking shows that 23% of participants chose 'stability of the social structure' as the first criterion.

It is respectively followed by 'environmental sustainability and resource systems', 'economic efficiency and adequacy of services', 'suitability of transport services and sustainable mobility', 'integration of new ICTs in planning and mapping', as well as 'suitability of the built environment' and 'local governance and decision-making mechanisms' with a respective percentage of 15.8%, 15.4%, 12.7%, 11.2%, 10.9% and 10.9%.

Therefore, the feasibility of the participatory multi-criteria analysis will be verified by applying it to the synthetic criteria ranked first. Following the summary table of school surroundings performance criteria influencing children's mobility, this first criterion has been divided into two families of indicators for more consistency and to be able to address each criterion in an exhaustive manner (Table 02):

Quality of life and integration of the child

By applying the methodological process and formulas mentioned above (Figure 1), we have obtained the performance value of each indicator. The mean value allows us to obtain the index value of "Quality of life and child integration".

The 'Quality of life and integration of the child' index is equal to 1.61 (standardised value = 0), which means an average performance that needs to be improved. The indicator values fall into two categories, ranging from negative to average performance (Table 03), meaning that there are shortcomings in the Social Pillar of Sustainability that affect the quality of life of children, especially in the area of school.

Table. 3. Indicator values related to the synthetic criterion 'Quality of life and integration of the child'.

Synthetic criterion 'Quality of life and integration of the child'	Weighting scores of synthetic criteria (SCx)	Notation systems			Performance evaluation of school surrounds (Vx.n)	Standardised value of index (Z Sc)
		Notation of the relevance $1 < N_R < 3$	Expert evaluators scoring $\Sigma N_{Ex.} = 10$	Children's Subjective scoring $1 < Ns < 3$		
Training and awareness	0.23	3	3	1	2.10	0.50
Comfort and well-being		3	3	1	2.10	0.50
Equity and citizenship		3	2	2	2.70	1.11
Social Mixing and Perception		1	1	2	0.46	- 1.17
Socio-economic factors		3	1	1	0.69	- 0.94
Mean performance value of the criteria					1.61	0

Source: Authors.

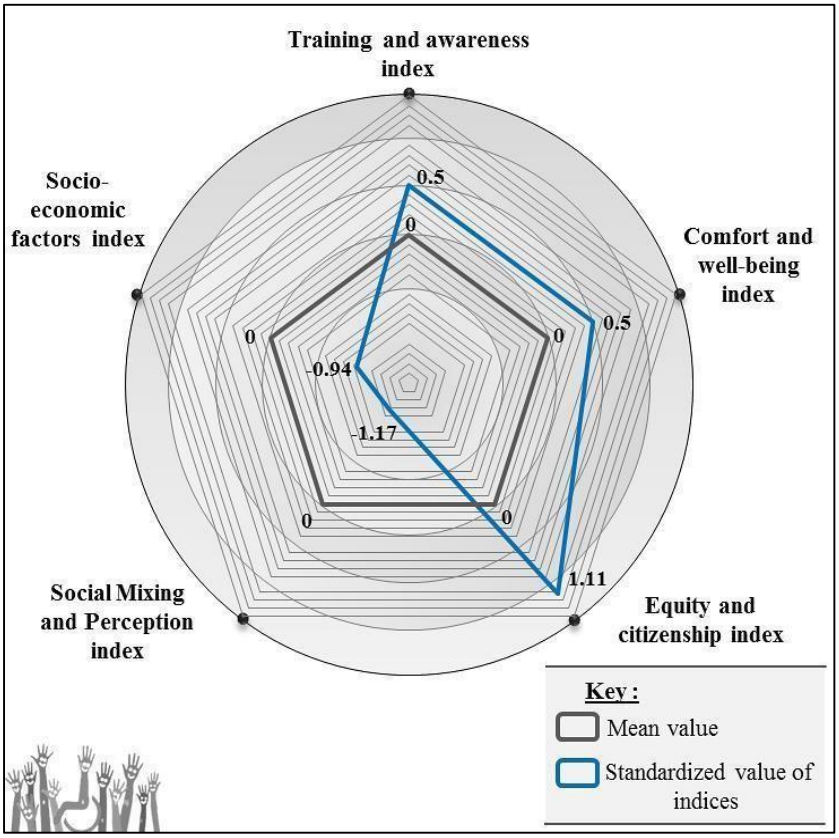

Fig. 5. Performance indicators for the 'Quality of life and integration of the child' criteria. Source: Authors.

Based on the results for each indicator (Table 03), the 'Equity and citizenship', 'Comfort and well-being' and 'Training and awareness' indicators achieved average performances, respectively followed by the 'Social Mixing and perception" and "Socio-economic factors' indicators.

The index values for 'Equity and Citizenship', 'Comfort and Well-being' and 'Training and Awareness' vary between 1.11, 0.5 and 0.5 respectively, synonymous with average performances that reflect a reality that

is not sufficiently suitable for children and that affects their behaviour in terms of mobility on the school surroundings.

The indicators of 'Social mixing and perception' and 'Socio-economic factors' obtained negative values of - 0.94 and - 1.17 respectively, synonymous with poor performances that are translated into negative attitudes by the children due to the unsuitable conditions.

Security and safety of child around school

The 'security and safety of child around school' index is equal to 1.46 (standardised value = - 0.002), which means a negative performance that needs to be deeply corrected.

The values of the indicators fall into two categories of results, ranging from a negative performance to an average performance (Table 04), which means that there are deficiencies in terms of children's safety around school.

Table. 4. *Indicator values related to the synthetic criterion 'Security and Safety of Child around School'.*

Synthetic criterion 'Security and Safety of Child Around School'	**Weighting scores of synthetic criteria (SCx)**	**Notation systems**			**Performance evaluation of school surrounds (Vx.n)**	**Standardised value of index (Z_{Sc})**
		Notation of the relevance $1 < N_R < 3$	**Expert evaluators scoring $\Sigma N_{Ex.} = 10$**	**Children's Subjective scoring $1< Ns < 3$**		
The existence of a surveillance system	0.23	2	2	1	0.92	- 0.50
Social safety		3	2	2	2.76	1.22
Road safety		3	2	1	1.38	- 0.07
Hygiene and health safety education		3	2	2	2.76	1.22
Perception of dangers and fire prevention measures		2	1	1	0.46	- 0.94
Prevention of natural disasters		2	1	1	0.46	-0.94
Mean performance value of the criteria					1.46	-0.002

Source: Authors.

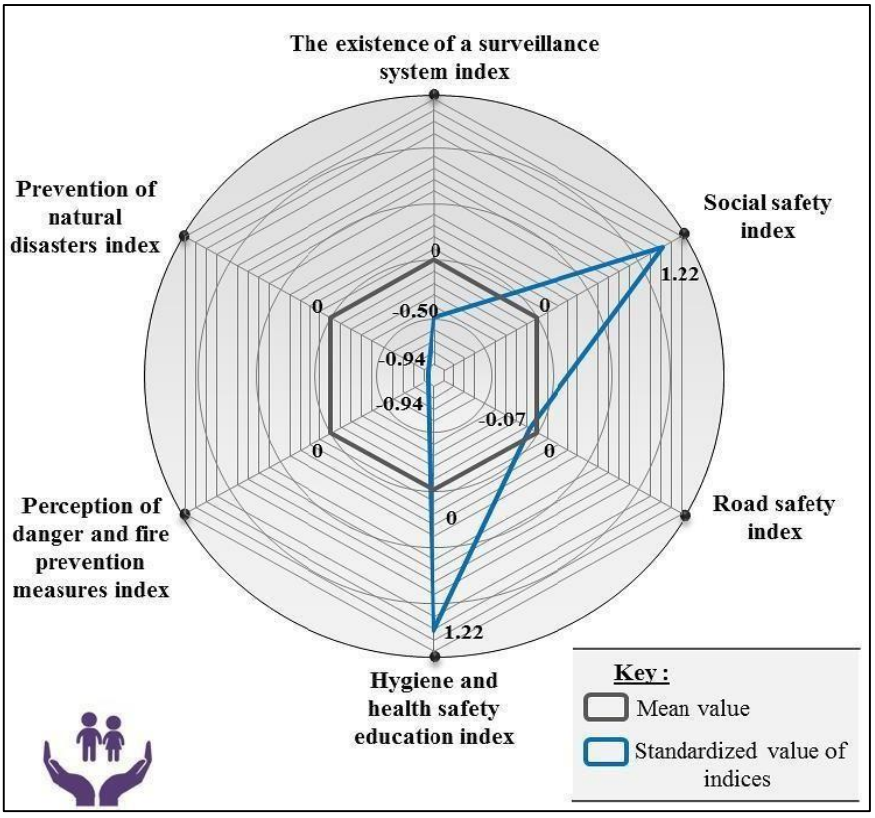

Fig. 6. Performance indicators for the 'Security and Safety of Children around School' criteria. Source: Authors.

According to the results obtained for each indicator (Table 04, Figure 06), the ‘Social safety’ and ‘Hygiene and health safety education’ indicators both obtained the same average performance, respectively followed by the ‘Existence of a surveillance system’, ‘Road safety", ‘Perception of dangers and fire prevention measures" and "Prevention of natural disasters" indicators.

The values of the ‘Social safety’ and ‘Hygiene and health safety education’ indices are equal to 1.22, synonymous with average performance, which highlights the lack of safety in terms of health and social safety that children experience.

The indicators ‘Existence of a surveillance system’, ‘Road safety’, ‘Perception of dangers and fire prevention measures’ and ‘Prevention of natural disasters’ had negative values of - 0.07, - 0.50, - 0.94 and - 0.94 respectively, synonymous with an inadequate performance that reflects the inappropriate attitudes of children due to the unsuitable conditions they are exposed to.

Discussion

This research has approached the notion of the suitability of the school environment for the needs of children mobility from a multi-faceted social standpoint, using a participatory multi-criteria analysis. It differs from previous multi-criteria studies, where scientific researchers have generally focused either on the school's internal environment, or on the child's home-school journey or the school surroundings, using others criteria and indicators (see the theoretical framework section). Its criteria and indicators are extracted from recent UNICEF documents and contextualised according to the objectives of the research, trying to deal exhaustively with the social suitability of the school surroundings for children’s mobility.

Quality of Life and Integration of the Child

- ***Training and Awareness Indicator***

The index of 0.5 reflects an average performance, revealing that pupils take part in limited awareness-raising activities, which are often not very diversified and occasional. This finding highlights the need to step up efforts to raise awareness among pupils and their families in key areas such as road safety, first aid, sustainability and spatial perception, as well as health and civic rights education. These actions are essential to strengthen pupils' relationship with their immediate environment and encourage safer, sustainable and responsible mobility practices.

The pupils only mentioned that the Directorate of Civil Protection organizes awareness-raising campaigns in schools from time to time, with the aim of enriching pupils' psychological potential and developing their awareness of the dangerous situations around them, such as accidents, and improving their behaviour and urban practices from an early age. This finding reveals a lack of decision-making in terms of awareness-raising. Our results are therefore reinforced by those of researchers who have emphasized the need for awareness-raising given its positive long-term impact on children's behaviour in terms of mobility and sustainability (Gandini et al., 2019; Rohmantoro et al., 2018). As a practical action, local education authorities, with the help of other decision-makers, can take a number of educational measures to make pupils and their parents aware of all the issues surrounding them and help them to improve the child-space relationship by behaving autonomously and appropriately.

- ***Equity and Citizenship indicator***

It is a context that makes the school environment a space where children's civic rights must be embodied in a sufficiently equitable way to give them a sense of citizenship. During the survey phase, we tried to verify the indicator in more detail by examining the different aspects of equity: equity between normal and disabled children, equity between children and adults, equity in terms of accessibility (transport, mobility and facilities), and social equity.

The indicator "Equity and Citizenship" had an index value of 1.11, which is fairly well. According to the school data, 6% of the pupils are included in the school despite their exceptional situation due to their disabilities and chronic illnesses (autism, mental retardation, handicap...). This kind of social mix gives them a sense of inclusion and equality in the school environment, as mentioned in the Convention on the Rights of Persons with Disabilities (UNICEF, 2008). Unfortunately, all children, including those with disabilities, are completely spatially excluded by physical barriers (lack of ramps, educational signalisation and safety features...). It is therefore difficult for the child to have access to the necessary facilities and, in particular, to the school, because the outdoor environment is designed by and for adults. As a result, the young child is undoubtedly confronted with conditions that are inappropriate for his age. The work of (Caro et al., 2021;

Pizzol et al., 2021) supports our findings; they confirmed that the urban parameters outside the school are of paramount importance for an inclusive and walkable area for pupils.

According to documents issued by (Education Directorate of the Wilaya of Guelma, 2021b), school transport is only available to children living in semi-urban and rural areas, depending on the distance between home and school. In Guelma city center, access to school transport is completely non-existent and is replaced by the urban transport system, which charges the same price for a child as for an adult. As a result, urban children experience a sense of exclusion and inequality when travelling to school.

- ***Social Mixing and Perception Indicator:***

This indicator obtained a negative performance value of -1.17, which expresses that there are weak interactions between pupils, which do not allow them to develop their perceptions due to the lack of mixing at different levels. Social mixing is not simply a mixture of boys and girls, or even of randomly selected groups of children.

The selected school attracts children from several neighbourhoods, despite the fact that the schools are distributed at the level of each neighbourhood according to the logic of traditional urban planning. The negative value is therefore justified by several reasons, first and foremost the accompanying practices (more than 87.4% of children are accompanied by an adult). This dependence not only limits children's autonomy and mobility, but also restricts the promotion of a social mix and the enrichment of their interactions outside the school environment. Furthermore, the current spatial conditions around schools accentuate the marginalisation of children in their urban environment by restricting their mobility, contributing to social marginalisation, even though the areas around schools play a crucial role as social learning spaces, where the child is confronted with new experiences to manage and a large amount of knowledge to acquire under the shadow of social mixing.

By placing the emphasis on schools environments, our results highlight the importance of improving the social mix in the area around schools. Such an improvement would be beneficial by fostering enriched communication between schoolchildren, adults and their peers from a variety of socio-cultural backgrounds. The work of (Mendoza, 2019) corroborates this perspective by showing that social mixing, when accompanied by meaningful interactions, can contribute to the development of democratic attitudes among pupils and their parents. Furthermore, an increased social mix among schoolchildren could play a role in reducing accompanying practices, particularly if the spatial conditions of home-school journeys including the school surroundings, are adapted to encourage autonomous and safe travel.

The issue of social educational mix, whether it concerns ordinary children or children with disabilities, is often approached by researchers, policy-makers and psychologists from the angle of the environment inside schools. However, the space surrounding the school, which is often neglected, also plays an essential role as a place of transition and socialisation. This space can foster an atmosphere that is inclusive, welcoming and conducive to diversity among ordinary and disabled people, adults and children.

- ***Socio-Economic Factors Indicator***

Socio-economic factors play a decisive role in the issue of children's mobility to and from school. According to the (Larousse, n.d.), these factors are defined as "related to social problems in their relation to economic problems", in other words, living conditions such as household income, state of health and state of housing. In this sense, children who have good living conditions, i.e. a considerable household income, decent and adequate housing and good health, reflect a favourable socio-economic situation. Conversely, precarious conditions can hamper their opportunities and well-being.

In the context of our study, the ‘socioeconomic factor’ indicator reaches a negative index value of -0.94, revealing that the majority of children live in restrictive socio-economic conditions that do not allow for having a private vehicles. As a result, pupils' travel practices are strongly influenced with other factors such as Household income, state of health and children's safety. Household income affects the availability of a private car and the mode of commuting for children. In our case, over 84.7% of pupils walk to school, accompanied by an adult, while the rest use other means such as the car or urban public transport. These data underline the importance of a better understanding of the interactions between socio-economic conditions and school mobility.

These results are consolidated by those of (Liu, Ji, et al., 2018), who mention that socio-economic conditions (number of vehicles in a household and household income) are determinants. In addition, it is crucial to note that there is also a category of parents who feel obliged to accompany their children every day because of their disability (6% of children with health exceptions). The above-mentioned determinants therefore contribute to the direct interaction of children with the school environment. It is an advantage that enables pupils to develop their spatial skills if their family's socio-economic circumstances have a positive impact on their attitudes and behaviour. Although the scope of this indicator has other implications, such as school

outcomes, family relationships, etc., which affect the psychological aspect of children, we have tried to link it here to the context of pupils' mobility.

- ***Comfort and Well-being Indicator :***

The social indicator 'comfort and well-being' is linked to other indicators, both material and immaterial, in a complex systemic relationship. In the surroundings of the chosen school, children undoubtedly need social comfort and well-being in terms of mobility in order to improve their interaction and behaviour with the external environment. The existing social deficiencies mentioned above; lack of awareness, feelings of inequality stemming from spatial and social marginalisation, sometimes difficult socio-economic conditions, etc., logically lead to a state of physical and moral discomfort around the school and the urban space in general, as confirmed by the index obtained, which shows an average performance of 0.5. In other words, the existence of deficiencies in the social indicators leads to a state of discomfort in the multidimensional 'comfort and well-being' of children's that affect directly their mobility. For children to feel comfortable in their school or in public spaces in general, they need to be aware of what is happening around them, to live in social and economic conditions that meet their daily needs, in an equitable, inclusive and safe atmosphere, and in a friendly space.

Research results of (Bronfenbrenner, 1979; Gorza and Bolter, 2012) support our findings and comments by confirming that child well-being is a multidimensional concept that is complex to measure, encompasses different concepts that affect the child's body and mind, and varies depending on the context of the study. Therefore, the treatment and analysis of this indicator must include the previous results in order to explain it in a broader sense according to the context mobility around school.

Security and safety of child around school

- ***Indicator of the Existence of a Surveillance System***

The result - 0.5 shows that the chosen school has no surveillance system in its surroundings. In fact, the negative value of the performance corresponds to a low level of surveillance control (presence of only one agent at the main entrance of the school and 2 police officers near the school). Consequently, this indicator is not taken into account by the school itself in order to guarantee the security of its surroundings.

This situation is confirmed by the anxiety of parents, who are always present to accompany their children (Figure 4), for a variety of reasons: social insecurity, road safety, the young age of pupils, the home-school distance and walking conditions, etc. In this sense, the implementation of a technological surveillance system around the primary school is a priority action to enable surveillance at all times and also to contribute to the creation of a reassuring climate against social and technical phenomena that affect children, such as physical or moral violence, child abductions,accidental risks or malfunctioning fire alarms and, indirectly, the introduction of self-discipline for pupils and adults.

Our result is consistent with previous studies; the work of (Che Soh and Ahmad, 2019) confirm that CCTV can help students to be disciplined and have safe conditions at the same time. (Alexandrie, 2017) on his part, found that video surveillance can be a tool to measure crime, especially in the school environment. To improve performance, the implementation of a surveillance system around school will help to ensure social security and road safety through its indirect role in moderating speed and organising traffic by encouraging self-discipline among drivers, and indirectly overcoming design deficiencies related to the planning process, especially in school areas. Therefore, it encourages pupils to move around independently and to develop their cognitive and relational skills.

- ***Social Safety Indicator***

The finding of 1.22 is higher than the mean of the performance, indicating that the majority of children and their parents have a considerable feeling of social security. This may mean that parents accompany their children for other reasons, such as road safety, distance travelled, age of the child or poor walking conditions.

However, it does not deny that there are other categories of children who are accompanied by adults due to a feeling of social insecurity resulting from the phenomenon of child abduction that Algeria has experienced over the last decade (Ben Taiba, 2018). Similar research was carried out on journeys to a primary school in Japan, and the results showed that walking to school was positively associated with safety from crime, CCTV cameras, etc. (Hino, Ikeda, et al., 2021)**.** These findings reinforce our conclusions indicating that social safety is primordial for children to use these spaces and move around autonomously.

In order to improve performance, it is essential to raise awareness and train elected representatives and decision-makers, as well as to involve the triangulation of children, parents and educational actors in order to collaborate in improving the current situation. To fill the gaps, national and local data management platforms

must also be set up to map social phenomena using ICT tools, which will then be useful for a well-defined action plan. In the short term, a physical environment with an open visual perspective is one of the child's standards for a safe urban area. In addition, a monitoring system is needed to achieve the desired performance and ensure the safety of pupils around schools and in urban areas.

- Road Safety Indicator

The negative result of -0.07 indicates that the indicator has not achieved the desired performance. Road safety measures were not taken into account in the design of the surroundings of school. This can be seen in the anxious parents who accompany their children every day (Figure 4). 15.3% of the parents are involved in intensifying the phenomenon through motorised mobility. These parental attitudes have multidisciplinary and polysemous repercussions that negatively affect several aspects of children's lives: their safety, their autonomy, their cognitive and relational development, and their urban practices.

The in situ observations show that this indicator is strongly correlated with the physical environment, which is characterised by a multitude of deficiencies, such as: the absence of road and pedagogical signs in the surroundings of the school, confirming the situation neglected by the municipal authorities.

In fact, the school is located at the crossroads of intense traffic flows; several urban transport lines and heavy vehicles pass in the immediate vicinity of the entrance, as well as the presence of a petrol station, which has intensified traffic.

There are also poorly designed and inappropriately located bus stops, the presence of congested junctions, the invisibility of the school entrance, the grabbing of pedestrian space by illegal traders, the lack of pedestrian crossings, and the exclusion of disabled children. All these elements are strong arguments for our result, which highlights the dangerous situation that threatens schoolchildren. Scientific experiments carried out in similar contexts on children's road safety on their journey to school, and its surroundings (Poswayo, Kalolo, et al., 2019; Salleh, 2023) have reached conclusions that support our results and confirm all the previous statements.

- Indicator of Hygiene and Health Safety Education

The index of 1.22 that the state of hygiene and health safety education (standards of cleanliness, sanitation and water supply) in the school area is quite performing according to the opinions gathered from parents and children. However, they pointed to some major problems, in particular the poor waste management from informal trade (Figure 4). This waste creates an olfactory nuisance and functional obstacles that compromise the comfort and safety of children on their journey to school. In addition, the proximity of a service station accentuates the problems of air pollution, exposing schoolchildren to even greater health risks.

In the last decade, in a similar context, several studies have been carried out in sub-Saharan Africa to combat pollution, pandemics and diseases that are spread among individuals, including children, or they have addressed the sanitary and hygienic side as a challenge through outdoor sanitary facilities, but they are still not adapted to the needs of children and need to be optimised (UNICEF and WHO, 2018).

In the context of children's mobility around schools, these factors pose multiple challenges relating to public health and the quality of home-school journeys. Similar studies carried out in sub-Saharan Africa over the last decade have explored these issues, particularly in the fight against pollution, pandemics and diseases that are spread among individuals, including children, or they have addressed the sanitary and hygienic side as a challenge through outdoor sanitary facilities, but they are still not adapted to the needs of children and need to be optimised (UNICEF and WHO, 2018). To achieve the required performance, these findings highlight the importance of an integrated approach to improve not only infrastructure but also the mobility experience of schoolchildren to meet hygiene and health safety standards in a safe and healthy urban environment.

In Guelma city, poor management or lack of maintenance sometimes leads to problems that affect the external environment, such as cracks in water and sewerage pipes, which cause nauseating odours, and the loss of large quantities of water, which over time causes deep pits. This situation is a source of great danger during the child's journey to school, as well as a sanitary danger, where users, especially the child, can transmit diseases and infections to the community.

In this sense, hygiene education at school age through awareness campaigns and workshops is a crucial step to have a child promoter of present and future sustainability. In response to this initiative, Algeria, and in particular the wilaya of Guelma, has launched an operation to rehabilitate primary schools, including sanitary spaces, to improve and fill the hygiene gap (Siouane, 2019). However, these actions need to be extended to the areas around schools, to make these spaces more effective in terms of hygiene.

- ***Indicator of Perception of Dangers and Fire prevention Measures***

The fire prevention measures outside our school are completely absent in the urban area and especially in the surroundings of the establishment, whose index reached a non-performing value - 0.94. As a result, the inhabitants, especially the little ones, are often exposed to dangers at all times, either due to malfunctions (power cuts, gas leaks...) or deliberately set. This creates a feeling of insecurity and discomfort.

The article of (Schulze, Fischer, et al., 2020) supports and reinforces our findings by highlighting the impact of wildfires on schools and their vulnerable users. From a regulatory standpoint, the Algerian legal aspect is saturated with regulatory texts on fire safety, but it still needs to be upgraded in terms of current techniques aimed at ensuring sustainability and resilience. An integrated approach, combining risk prevention and safe planning around schools, would contribute to boosting the confidence of children and their families in their daily journeys.

In the context of children's mobility around the chosen school, it is crucial to recognise that safety measures remain largely inadequate if they are not extended to child-friendly infrastructures. Public spaces, including school surroundings, can be suddenly exposed to emergency situations, such as fire. This underlines the importance of devising specific evacuation and safety plans, especially, around schools.

Ensuring overall safety requires an integrated approach, with decision-makers, urban planners and designers prioritising the development of appropriate emergency plans. These plans must be based on rigorous scientific research and exploit the potential of information and communication technologies (ICT). By modelling and simulating potential risks, it is possible to design solutions that enable rapid and coordinated evacuation, while protecting the children who spend a significant part of their day in these spaces. Such an approach not only promotes the physical safety of pupils, but also helps to reassure families and communities.

- ***Natural Disaster Prevention Indicator***

Children's mobility around schools cannot be dissociated from the problems associated with natural disaster prevention (high winds, earthquakes, floods, Saharan sand tornadoes...), which is a key indicator in children's safety in and around school infrastructures. According to (Yelles-Chaouche et al., 2006), the city of Guelma is an active tectonic zone, belonging to category two (02) of seismic zones.

Based on the results of the survey, the indicator obtained the lowest index -0.94, indicating that the school's surroundings do not meet the norms of seismic risk prevention. The wilaya of Guelma, as well as the neighbouring wilayas, are subject to earthquakes from time to time. This situation highlights the urgent need to incorporate preventive measures, such as seismic-resistant infrastructure design, appropriate evacuation plans and effective warning systems, particularly in sensitive areas, especially in facilities and sensitive areas used by children, in order to guarantee their safety and achieve the desired performance.

The work of (Wang, 2016) support our findings and comments. The researcher confirm that school resilience to natural hazards can be enhanced through effective disaster management. This includes actions such as developing practical plans, training in risk management and conducting simulation exercises, etc. Statistics following natural disasters show that children are often among the main victims of natural disasters: Recently, the devastating earthquakes in Turkey and Syria affected 3.7 million children (UNICEF, 2023). As a preventive action to ensure children's safety around schools; A comprehensive approach can include education on disaster risk reduction (natural hazards, wildfires, etc.), the introduction of evacuation plans, as well as adapting school routes to avoid high-risk areas. In addition, information and communication technologies (ICTs) play a key role in simulating and mapping environmental threats, enabling informed and participatory decision-making. By combining these tools with planning focused on safe mobility, it becomes possible to create a resilient and protective school environment for children.

In general, the overall index value of the synthetic criterion 'Stability of the social structure of children' is 1.54 (the standardised value is equal to -0.001), which means that there were deficiencies affecting the social sustainability of schoolchildren; 6/11 indicators had negative values, meaning that major improvements in performance are required. The remaining 5/11 indicators had average values, which means that there is a need for correctives actions to remedy the shortcomings.

Several difficulties were encountered in our assessment process: two operational difficulties were experienced during the in-situ investigation, which took a long time, and the reluctance of some pupils to express their opinions because they were not used to taking part in such activities due to a lack of awareness of the participatory approach and their civil and social rights, aimed at improving their school environment and their mobility.

Children's mobility around schools poses specific analytical challenges. First of all, the definition of the indicators needed to assess the social aspect of mobility must be adapted to the context of the study, based on

scientifically validated foundations. In this case, the flexible nature of the multi-criteria hierarchy can be an effective solution, by proposing sub-indicators for each indicator to make the analysis more accurate.

In addition, the absence or inadequacy of data relating to social aspects and safety is a major limitation to the concrete evaluation of children's perceptions and behaviour. This highlights the need to develop rich and accessible local databases to support researchers in their work.

Furthermore, recent scientific work on school surroundings cases is still limited. As the issue of school environment has not previously been dealt through the same methodological process, particularly at national level. This research stands out for its integrative and contextual approach: whereas other studies have often treated the indicators separately or using distinct methodologies, it highlights the specific nature of the criteria chosen and their anchoring in a given geographical area. This makes it a unique contribution to understanding the interactions between the school environment and social aspect of children's mobility.

Our research is a promising starting point for further scientific investigations into children's mobility around schools, particularly in Algeria. By concretely verifying each indicator using appropriate experimental tools, it paves the way for more targeted studies based on the child standards established by UNICEF and its partner agencies. This work highlights the importance of integrating pedagogical and mathematical approaches to grasp the social dimension of children's mobility, while also taking account of intangible indicators.

The results obtained can guide local authorities and political decision-makers by providing decision-making tools aimed at optimising management of the safety and well-being of children on their journey to and from school, particularly in the surroundings of educational establishments. This data can be used to identify the strengths that can be enhanced and the weaknesses that can be improved, in order to guarantee a safe and accessible school environment. This approach is part of a sustainable development and transparency approach, which is essential to ensure a better future for current and future generations.

Our methodological contribution can be even more beneficial if the data collected are linked to their spatial context by means of geographical information systems. Therefore, it is possible to create a simulated negotiation through computer modelling, where children and their parents, educational stakeholders and local elected representatives can co-assess and co-resolve school mobility issues in a transparent manner and in the short timeframe required to achieve a sustainable and resilient reality. Moreover, given the flexible nature of our multi-criteria analysis, it can be developed and used in other contexts (rural or Saharan schools surroundings, etc.) or in any urban area to assess its suitability for vulnerable children, based on the UNICEF standards. Our scientific experience supports researchers and public actors in rethinking how to make existing spaces, and in particular the school environment, compatible with the notion of child-friendly design.

Conclusions

In conclusion, school surroundings are spaces of a sensitive character and need to be designed according to children's standards to be suitable. For this reason, the issue of a child-friendly urban environment is the subject of intense debate, covering a range of topics: social, health, travel and mobility, etc., all of which are aimed at sustainable development and resilience.

Moreover, our scientific research aims at encompassing these topics in the spectrum of a participatory multi-criteria analysis allowing: first, to test the feasibility of the process as a decision support tool at the local scale. Secondly, to assess the performance of school surroundings to determine their suitability for children’s mobility. In addition, it can play an informative and educational role by raising awareness among pupils and their parents through a participatory process cited in the new Algerian constitution (Constitution Of The Popular Democratic Republic of Algeria, 2020). This initiative counts one of the first actions carried out with vulnerable children in Guelma, Algeria.

Based on documents issued by UNICEF and Its agencies, we were able to create a list of synthetic criteria scientifically validated on an international scale and contextualised according to our study context, including the needs of a child from 5 to 12 years old in the surroundings of his school and ensuring a balance between the pillars of sustainable development.

The validation and the feasibility of our proposed tool are examined through the case study of an urban primary school in Guelma, Algeria. The participatory multi-criteria analysis was applied to the ‘Stability of the Social Structure’ criterion which is divided into two criteria (Criteria of Quality of Life and Integration of the Child , Criteria of Security and Safety of the Child Around School) in order to examine its methodological viability and to treat each part in depth.

In effect, the overall index obtained 1.54 (standardised value = -0.001) highlights a worrying situation for pupils in terms of mobility around schools. This result reflects a clear failure to meet the social criteria of stability and safety that affect directly their mobility.

The marginalisation of children's fundamental rights, such as safety and a suitable quality of life, illustrates an alarming lack of consideration for this particularly vulnerable group. This situation compromises not only current social and human sustainability, but also that of future generations.

It is therefore crucial to integrate the child's perspective into the design and planning of school surrounds. These areas must provide a safe, high-quality environment that promotes children's well-being and social stability. By taking their specific needs into account, it will be possible to reconcile mobility and social sustainability.

The participatory multi-criteria analysis adopted in this research is a relevant tool for assessing the quality of spaces around schools, with a particular focus on children's mobility. By integrating objective diagnoses with the active participation of children, which is often neglected in planning processes at different scales, this approach offers a robust methodology for better understanding the specific needs and uses of pupils in their surrounding environment. In this way, it can be used to guide informed decisions aimed at improving the safety, accessibility and user-friendliness of home-school routes and adjacent school areas.

In conclusion, this participatory multi-criteria analysis is therefore a support tool for decision making that enables the analysis and making diagnoses through children's participation, which seems to be a missing link in planning at different scales. This part of research will be useful for the next level of negotiation involving other actors.

There were a number of limits to the operational process of evaluation, including the long duration of the investigation and the difficulty of involving the pupils in a process that was considered new for them. Other limits were raised during the analysis, such as the profound meaning of each indicator and the interrelationship between the different indicators, as well as the lack of local data, which forced the researchers to discuss the results obtained in depth. It is therefore necessary to develop local databases to enable researchers to achieve their research objectives.

With regard to the implications for future research, and given that recent scientific work on school surroundings and child-friendly design is still limited, particularly in Algeria, our research provides a starting point for further research, by concretely verifying the criteria and indicators linked to children's standards using other experimental tools. The flexible nature of our evaluation may enable other researchers to design other hierarchies based on the UNICEF standards and child- friendly planning.

As practical implications, the results obtained will serve local authorities and political actors as decision-making tools for consciously considering children in urban space through a participatory approach. Our methodological contribution can be even more effective if it is developed into an ICT tool that integrates geographical information systems, where children and their parents, educational stakeholders and local elected representatives can co-assess and co-resolve and geo-locate problems transparently and in the short time required.

In the long-term, it is necessary to develop guidelines for the planning and the construction of a child-friendly school zones. It should be noted that the criterion of child participation is inseparable because it is the cornerstone of our multi-criteria analysis. We have included it in the synthetic criterion of 'local governance and decision-making mechanisms' which will be developed later. This work represents only a small part of a research, which will treat other criteria and it will be combined by the participation of public actors related to this topic and a modelling system to illustrate the problem in a different way.

Being a signatory with UNICEF is only a superficial point that does not indicate that the child problem is solved in Algeria. The resolution of the problems related to the child is an arduous task which needs a well-designed comprehensive plan and ongoing monitoring based on the principle of sustainability and resilience and incorporating the child as a key actor for the sustainability process.

Conflicts of Interest:

The authors declare that they have no conflicts of interest regarding the publication of the paper.

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