What Affects Children's Travel Behavior and How Can They Contribute to Sustainable Mobility? Building a Framework Considering Sustainable Mobility Education and Gamification

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Children's behavior is different from adults' behavior which is a result of many direct and indirect variables and characteristics. Hence, analyzing children's travel behavior and recognizing their actual needs while raising awareness of the latest trends and possibilities through sustainable mobility education (SME) tools and gamification would lead to a productive dialogue between children and practitioners bringing about positive outcomes for both groups; especially in the digital era where Information and Communication Technology has changed and is continuously changing the way we move around and communicate. This paper reviews the existing literature about travel behavior, SME tools and gamification concept from which an integrated framework is inferred. This framework explores the ways children can become agents of change toward sustainable mobility based on their travel needs and how they can take responsibility and get motivated for their travel choices in a long-time procedure and in cooperation with their parents.

Key Words : *Children, Travel Behavior, Sustainable Mobility Education, Gamification*

1. INTRODUCTION

Mobility is a big part of living in a city and while it can bring about advantages and opportunities, it may burden people and environment at the same time. In order to prevent the adverse effects of this for current and future generations, we need to review and analyze our travel behavior in search for the criteria leading to CO2 emissions reduction (Schoenau and Müller 2017). (Zwerts, Allaert et al. 2010) believe that as far as transportation is concerned, children have not been taken into account as first-hand sources of information. In fact, they were viewed under the influence of parent's thoughts and concerns. However, (Carroll 2017) argues that children have a deep understanding and expertise regarding matters that affect them and including them in the process of decision and policy making can contribute to the realization of their needs and thoughts. Therefore, studying children's travel behavior is of great value for the existing literature. However, this is not the only focus of this research in developing the framework; as the authors of this paper view a sustainable mobility planning in an ongoing participation with children through Sustainable Mobility Education (SME) and gamification which will be introduced later in this paper.

2. TRAVEL BEHAVIOR & INFLUENCING FACTORS

Human behavior is under the influence of so many different direct and indirect factors. One of the well-known theories in this filed is the "Theory of planned behavior" (TPB) (Ajzen 1991) which discusses about the factors, namely attitude, subjective norm (SN), and perceived behavioral control (PBC), contributing to an intention which finally result in a

specific behavior (Ajzen 1991). Mobility is a kind of human behavior; therefore, all of these psychological dimensions can play a great role in the area of children's travel behavior. In addition, (Schoenau and Müller 2017) suggest including three other factors in a mobility context, namely habit, external costs and socio-economic status of an individual like age, income, gender, etc. Regarding children's travel behavior, their parents' travel behavior and attitude should be highlighted as well. Children's spatial knowledge, distance and frequency of the trips could also be important elements which need to be considered while investigating the travel behavior of children.

3. SUSTAINABLE MOBILITY EDUCATION

Although, to the best knowledge of the authors, Sustainable Mobility Education do not exist in this phrasal form in the academic literature, its concept as mobility management, sustainable mobility educational tools etc. could be found in the literature, some projects and workshops worldwide. There are similar movements in other disciplines as well, such as Built Environment Education (BEE). In fact, BEE can provide a great opportunity for children to be a part of design and planning processes (Million 2017). However, as far as mobility and eco-mobility is concerned, many attempts have been done across the globe to make sustainable mobility as part of a day-to-day life experience through education and raising awareness. Traffic Snake Game (TSG) is one of the successful movements trying to influence the behavior of primary school children by encouraging them to walk or cycle to school. 2020 CIVITAS project is another example which digs the opportunities for changing travel behavior of kids and their parents. In terms of educational tools, Le Guide Pédagogique de la Mobilité Durable is a good example of educational guide on eco-mobility which is designed in France and its target audience are children aged 12-15 at school or outside school. These kinds of projects and tools could contribute to a long-lasting effect on children's travel behavior even when they grow up, and that is why they have been included in the framework.

4. GAMIFICATION

Mobility is getting smarter every day and makes it, not necessarily difficult but, more challenging for the service providers to engage users in this new perspective and especially to more sustainable mobility behavior (Kelpin, Giesel et al. 2016). Considering children as the main topic of this research, sustainable mobility should involve parents and children simultaneously, and that is how gamification can come in handy. (Gerosa, Marconi et al. 2015) believe that Information and Communication Technology (ICT) tools will have a great impact on parents' point of view about children's independent mobility and can boost sustainability in the long run. Gamification tools and techniques could be considered in different scales of the community. However, running an open comprehensive platform for children's independent mobility and including gamification in a community-scale that was discussed by (Gerosa, Marconi et al. 2015) need a group of experts and huge funding; therefore, it may not be applicable in many situations. We believe that this process could start from more simple steps which will be discussed while presenting the framework later.

5. DISCUSSION

As it was discussed earlier, in order to build a framework for children's sustainable mobility, it is vital studying children's travel behavior which could be affected by many different factors. One of the main objectives of this research could be identifying the degree of importance and correlations between these factors which can help in choosing the best approach for designing the sustainable mobility education tools. Authors believe that these tools along with gamification techniques in collaboration with schools and parents could lead to children's sustainable mobility. Regarding Gamification techniques, this research suggests focusing on executing pilot apps at schools which can record children's mobility behavior representing information about the Calorie burned or the ecological footprint as CO2 emissions online or in the form of monthly reports, etc. This information along with incentives provided by school or parents can promote children's participation and motivate them toward sustainable mobility choices in a long period of time. The framework is demonstrated in Figure 1.

This framework shows that one of the most important and primary issues in achieving children's sustainable mobility is to study children's travel behavior. Due to the complexity of travel behavior, an interdisciplinary approach is suggested for this phase which brings quantitative characteristics of travel behavior along with psychological aspects. Those

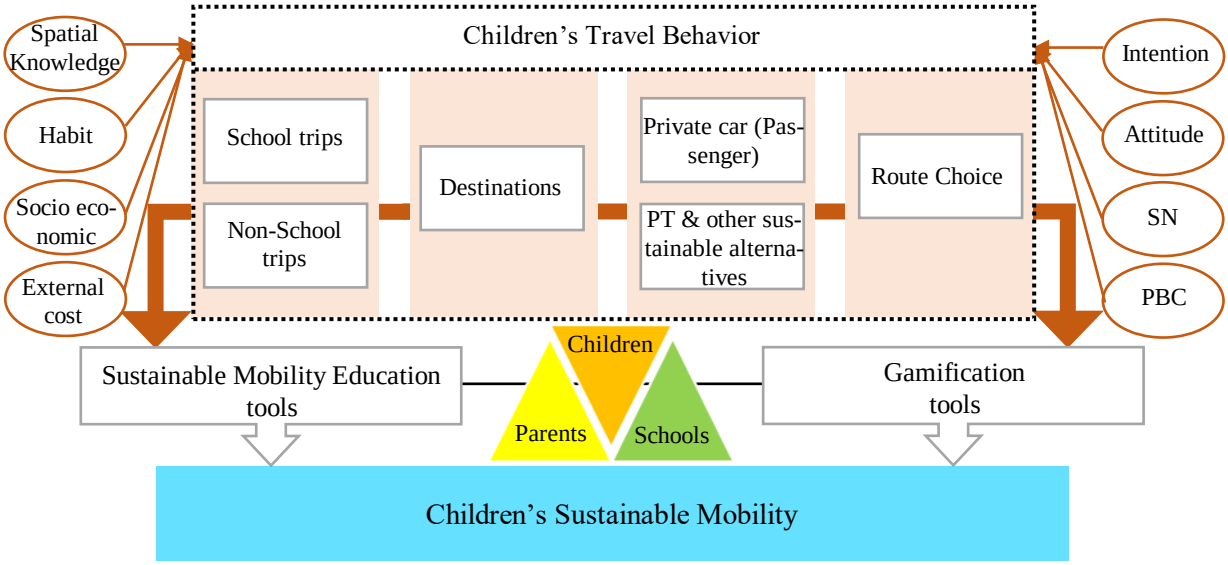

Figure 1 Children's sustainable mobility framework (Authors)

elements represented in oval shapes at the sides of the figure are some of the most important factors which could have complicated impacts on different criteria of children's travel behavior which are categorized as 4 topics in this framework including 1) trip types as school and non-school trips, 2) trip destinations (specifically for non-school trips), 3) mode choice as in two classifications of private-cat (passenger) or public transport (PT) and other sustainable alternatives, and 4) Route choice.

Considering the results of this phase, sustainable mobility education and gamification tools can be applied to facilitate the main objective of the framework which is to achieve children's sustainable mobility. In this sense, the framework suggests close collaboration of children, parents, and schools which can guarantee a continuous and active involvement for a long period of time. Moreover, the results of the first phase can be used in the process of designing both of the mentioned tools.

6. CONCLUSION

This research intends exploring the scope of children's travel behavior in search for children's sustainable mobility with the help of education tools and gamification. It seeks participation and cooperation of children, parents and schools in a long run for fruitful results. It is noteworthy that factors and criteria influencing children's sustainable mobility are not limited to those considered in the framework. Authors of this paper believe that applying this framework can open up new opportunities in the field of sustainable mobility both theoretically and practically.

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REFERENCES

1) Schoenau, M. and M. Müller (2017). What affects our urban travel behavior? A GPS-based evaluation of internal and external determinants of sustainable mobility in Stuttgart (Germany).
2) Zwerts, E., et al. (2010). How children view their travel behaviour: A case study from Flanders (Belgium).
3) Carroll, P. W., K (2017). Children as urban design consultants. Designing cities with children and young people . K. Bishop and L. Corkery. New York, Routledge: 105-118.
4) Ajzen, I. (1991). "The theory of planned behavior." Organizational Behavior and Human Decision Processes 50(2): 179-211.
5) Million, A. (2017). Preparing children and young people for participation in planning and design. Designing cities with children and young people. K. Bishop and L. Corkery. New York, Routledge: 223-236.
6) Kelpin, R., et al. (2016). STREETLIFE FIELD TRIALS – APPLIED GAMIFICATION APPROACHES AS A KEY TO MORE SUSTAINABLE MOBILITY BEHAVIOUR.
7) Gerosa, M., et al. (2015). An Open Platform for Children's Independent Mobility.