Individual Resilience and the Environmental Education for Sustainability as a Base of Community Resilience. A Case Study with High School Teachers

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Abstract This text describes the methodology and first results of a case study on the community resilience of cities that are recurrently affected by floods in the state of Veracruz, Mexico. A problem arising from the changes in the frequency and intensity of tropical cyclones resulting from climate change which mainly affects populations in poverty and those settled in high risk areas. It has been documented that populations resist, recover and even transform themselves in the face of adversity, which has been called community resilience. Community resilience is based on individual resilience and the latter can be developed through education. For this, a significant figure is needed, among other things, to provide relevant models of resolution as well as leadership. The case study confirms that young people can play a determining role during the floods; therefore the significant figure can be originated with theirs teachers. So, teachers with resilient characteristics are necessary to strengthen resilience in their students. Then, students could share individual resilience with their friends, family and neighbors, to create a social belt of transmission of resilience permeated by environmental education for sustainability. For this it is necessary to have resilient teachers. Therefore, this research identifies the individual and community resilience of high school teachers to provide a diagnosis to be considered in actions that improve their capacities of prevention, recovery and transformation to floods.

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1 Introduction

Research on community resilience is currently in a significant position compared to other studies, due to increased knowledge and growing concern about climate change (CC). Climate change is defined as a phenomenon associated to an increase of environmental deterioration, as well as to a series of disasters in different populations on a global level never seen before (Gutiérrez and González Gaudiano 2010).

CC is the result of the current model of developing countries. Considering the environmental situation and its increasingly serious nature; many cases leads to irreversible changes in nature. So in theory, it is not sustainable to continue to maintain the rhythm of exploitation of natural resources. Social inequality and global problems brought about by the devastation of natural resources (Colín 2003).

Economic growth has been the basis of development, without regard to social and environmental consequences (Maldonado 2008). The term development itself has a great myth within which phenomena such as industrialization, urbanization, concentration and accumulation of capital, as well as destruction of nature are concealed (Gutiérrez and González Gaudiano 2010).

There is a relationship between the model of growth, CC and disasters. That is, the type of current development is associated to progress and welfare, material growth and a high consumption of goods and services. In this regard, based on our lifestyles and model of growth, Riechmann (2005), argues that tropical cyclones (TCs) are born from the exhaust pipes of our cars and the chimneys of our nuclear power plants.

Some disasters are processes that are getting socially developed (with the deforestation, pollution, consumerism, inefficiency, corruption, among others), that harshly reveal themselves during episodes caused by extreme natural events, such as a tropical cyclone (Ruiz 2005). In other words, disasters are constructed in and by society, so they can be considered as latent phenomena with the expectation that contingencies may occurred.

In sum, the dominant model of development contributes to make worse diverse environmental problems such as CC. The intensity and frequency of some natural phenomena are related to CC, such as tropical cyclones. Nevertheless, this causal relationship is not always evident.

Therefore, CC is complex considering that it is difficult to see all its effects; with consideration that available scientific knowledge itself does not have all the answers about it. Some natural events have conditions that could be associated to science as an effect of CC. In recent years, for example, tropical cyclones such as Katrina (2005), Dean (2007), Irene (2011), Ingrid and Manuel (2013) have been registered

around the world, and at the same time, global average temperature has increased (Riechmann 2005; IPCC 2015).

Variations of climate exist as a consequence of the global average temperature. In addition, some phenomena such as frost, storms, droughts and floods affect entire populations because of the intensity in which they occur. In this sense, communities in marginal, economic and social conditions are highly vulnerable because they are more susceptible to suffer damages (Chardon and González 2002).

In 2014, hydrometeorological disasters were the phenomena with most impact, accounting for 58.7% of the total fatality of all disasters reported (Guha-Sapir et al. 2015). The effects of CC are global and harshly hit developing countries, especially those with poor communities settled in high-risk areas (González Gaudiano 2007). Coastal areas and communities that are close to rivers are most prone to flood disasters.

Mexico is located within the intertropical region in the middle of two large oceans: the Atlantic and the Pacific. TCs occur on both coasts and on average, 25 TCs are recorded per year. Around four or five of them usually enter in the territory and cause severe damages because of heavy rains with their consequential floods (CENAPRED 2001).

In recent years, in the coastal state of Veracruz, on the Gulf of Mexico, there is a large area that has been impacted by several TCs (Karl in 2010, Ernesto in 2012 and Barry, Fernando and Ingrid in 2013), which have resulted in disasters.

The highest level of precipitation during TCs has increased in the state of Veracruz. This is consistent with the observations made around the world, which indicates a significant statistically increase in rainfall intensity, although in a contradictory way, the annual average of precipitation in the state of Veracruz as a subtropical area has decreased (CNIAN 2012). The increases of the precipitation level of TCs, the vulnerability of towns of Veracruz and its geographical location have caused floods with human and economic losses. Communities respond in different ways to these types of disasters.

On the other hand, the IPCC (2015), defines resilience as the ability to recover of social, economic and environmental systems in order to confront, respond, or reorganise in the face of a hazardous event. In this way, the systems mentioned preserve their essential function, identity and structure while maintaining the capacity for adaptation, learning and transformation. Being resilient makes it possible to confront adversities by learning and transforming to reduce or eliminate damages. Individuals can develop resilience (Melillo 2001), and if many people combine their individual resilience, they can create community resilience (Gamarra 2010), which allows populations to adapt, learn and even transform in the face of adversities.

In this context, where the model of development, as well as CC and its effects frequently impact the populations of the state of Veracruz causing disasters, it is necessary to study the factors that favour the development of individual resilience in significant people who exert a leadership in the community. In our study, we have chosen high school teachers and the idea is to consider our results in order to

construct strategies aimed at developing abilities that allow local residents to resist, recover and/or transform themselves in the face of floods.

This research considers high school teachers as significant adults. Therefore, they are relevant figures in the creation of resilience (Munist et al. 1998; Melillo 2001). Teachers can provide resolution models, as well as leadership in young people, who can share this information to their families, neighbours, and friends to create a social driven belt, permeated by Environmental Education for Sustainability (EES).

2 The Social Driven Belt of Resilience and Environmental Education for Sustainability

The social driven belt is an analogy of the transmission belt related to mechanics. It is taken to the social field to illustrate the process and the elements that contribute to the development of resilient abilities in the face of floods. The transmission belts have the function of synchronously move two or more pulleys, so that they can generate power for a common purpose. In this process there are two types of pulleys: the drive pulleys and the driven pulleys. The drive pulleys are the ones that begin the movement. These pulleys rotate while transmit energy to the driven pulleys through the transmission belt that unites them.

In the social field, as in the mechanical process, there are elements that begin the movement, to whom we will name drive actors. These drive actors transmit information, motivation and knowledge to the driven actors through this social driven belt. These driven actors will subsequently become in drive actors, starting in this way a cyclical process.

A social driven belt gets established as the intangible element with properties of cohesion and coordination that involve the process of activation of drive and driven actors for the good of the community. These properties are continuously promoted and provided by all actors. The social driven belt unlike mechanics, considers that the elements in the process are not static. That is why actors will appear in different moments like drive or driven actors taking into account their abilities.

Teacher's work must transcend the classroom. It is inconceivable that the role of a teacher cannot be thought as static, nor it can be reduced to manage his students' learnings without interventions and without the contexts in which the educational process is developed. Teachers must consider the attention to social and environmental needs in their didactic strategies (Zabalza 1993), which means that they must extend their work beyond the classroom. The teacher would begin the movement (Fig. 1).

Although the social driven belt involves teachers, their own students, who are in their adolescent period, would be the immediate actors moved by the social driven
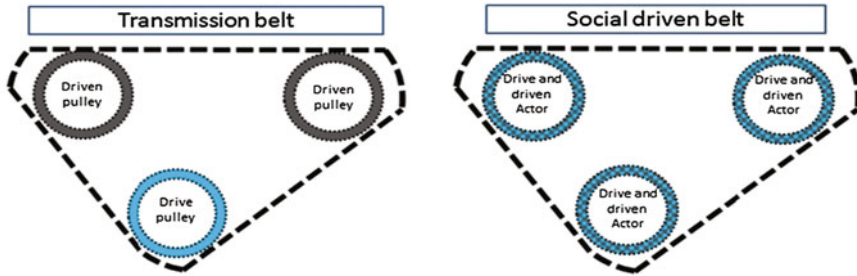
Fig. 1 Transmission belts: mechanics and social. *Source* Author's own elaboration

belt. It is in the adolescent period when skills are acquired, and behaviours are established, and the most important point is that project of life starts to be developed. In this period, individuals already have a type of formal thinking that allows them to confront, reflect, debate, analyse and draw their own conclusions that are connected to their realities (Alchourrón et al. 2001).

This belt will be permeated by the EES. This type of education appears as a viable proposal that contributes to confront environmental problems and their consequences (González Gaudiano and Arias 2009), which are greatly derived from the model of development, the CC and its effects, as we have been saying. The EES is understood as a liberating education that seeks the social transformation towards a living in order to better coexist between us and nature (Terrón 2010). It is characterized by a complex approach that allows the understanding that environmental problems are not isolated but are interrelated with other problems.

Social change from schools and promoted by EES can contribute to build a critical and independent thinking in students, families and communities when more teachers become involved in taking the challenge of developing the capacity to understand coherently the reality and the meaning of the world (González Gaudiano 2007). Therefore, the social driven belt permeated by the EES pretends a social change, where high school teachers and their students initially participate, followed by the rest of the community, creating in this way the conditions for building community resilience, in order to understand and to deal with environmental issues and their effects, such as floods.

The study is located in three towns in the central area of the state of Veracruz: Tlacotalpan, Cotaxtla and La Antigua. These towns have been affected several times by floods, having tropical cyclones Karl and Matthew as the most severe in 2010 (Tejeda 2011; Méndez 2014). This research considers four high schools. The town of La Antigua and Cotaxtla have one state high school each and Tlacotalpan has two state high schools.

3   Resilience: Concept and Study

In the social field, the term of resilience allows to explain, identify, evaluate and reinforce systems, institutions and people's abilities (Maldonado and González Gaudiano 2013). The term can be defined from three approaches (Uriarte 2013): stability, recovery and transformation. In this research, we agree with the process approach towards transformation. This approach emphasises people's abilities to adapt to changes, the ability to learn, creativity, future orientation, strengths and opportunities rather than hazards and weaknesses. In some cases, disasters can be constituted in opportunities in order to change or improve the inefficient living conditions of those affected (Olabegoya, 2006 in Uriarte 2013).

According to Melillo (2001), there are two interpretative paths of resilience. The first one is the geneticist interpretation that confirms the existence of individual who possess resilient innate characteristics. The second interpretative path is that resilient characteristics can be developed in certain situations throughout the growth of people. We based on this second path in which we associate the figure of significant adults or teachers, who can develop resilient capacities in their students so these last ones also will help the rest of the community to develop those capacities.

Munist et al. (1998) and Melillo (2001) have documented that throughout the growth of people, there is interaction with individuals, such as parents, educators and carers, who make sure that resilient capacities get developed. These individuals have a high social status before their children, students and people with whom they coexist, which is very appropriate in order to provide models of resolution and leadership.

In addition to the *significant adult figure*, there are other factors for the development of resilience. The first factor is belonging to *cohesive groups such as families*. Salamanca (2009), studied the experience of disasters lived by poor and middle-class families in Bolivia, making a comparison between the results obtained. It is highlighted among his results that disasters impact the stability of the family, so it is likely to find disruption and rupture in family relationships. However, beyond the socioeconomic level, the impact on family stability is in function of family cohesion prior to disaster (Salamanca 2009). Along those lines, Henderson (2001), has identified that resilience and socioeconomic status are not related because poverty does not make impossible the development of family cohesion, so the economic situation of a family is not a condition for it to be resilient or not, although the bond between members does it.

The second factor is the *Around the "I"* (Henderson 2001). It consists of three elements: (a) I have (b) I am, and (c) I can. These factors are characterized by some issues that are important when is time to confront adversities such as the attitude, self-confidence, character and support from close and beloved people.

In the case of teachers, the third factor is *work environment*. This factor gathers some elements such as prosocial bonds, life skills, affection and support, opportunities and high expectations and clear and firm boundaries (Henderson and

Milstein 2003). These six elements consider different actors with whom the teacher daily interacts, such as directors, students, parents and other teachers.

The fourth and last factor is *health and physical condition*. Healthy conditions without weight problems provide advantages compared opposite conditions when we found ourselves in front of adversity (Richardson et al. 1990).

In sum, the factors of development of resilience in teachers are: *cohesive groups or families, the Around the "I" factor, work environment, and health and physical condition.* The development of resilience in teachers is possible due to the strengthening of these factors. What is more, community resilience could be produced if people's individual resilience develop, coordinate and interact to each other in the same territory (Gamarra 2010).

In regard to community resilience there are other factors involved. Suarez Ojeda (2001) has identified four factors. The first factor is *collective self-esteem*, which refers to pride and satisfaction that a person has for feeling part of the community and the place where he/she lives. The second factor is *cultural identity*, which refers to a person's involvement in local traditions and acceptance and practice of his/her neighbours' ideologies related to entertainment, politics and religion. The third factor is *collective honesty*, which appreciate local authorities and neighbours' honesty. The fourth factor is *social humour*, which refers to the ability of kindly express a gloomy fact, so that through the storytelling, it is possible to cause a tranquillity effect before some tragedy.

In addition to these four factors, the authors of this article suggest two more factors derived from experiences in towns in Veracruz. These suggestions also come from researches made by Gamarra (2010). These other factors are *significant institutions* and *reflection from experience*. The *significant institutions* have a decisive role that directly impact on communities' tasks. In Gamarra's research (2010) made in Peru, it is illustrated how two institutions, one educational and the other a religious one worked together for the strengthening of local leaderships to put up with an armed conflict. The work of these two institutions got documented. They developed individual resilience until turn it into community resilience, which helped them to resist the armed conflict without suffering displacement.

Finally, the factor *reflection from experience* refers to the reflection on the damage experienced individually against the damage experienced by other most affected people. To think of oneself as fortunate to receive less damage than others, provides a feeling of optimism that activates the strengths to confront, overcome and even learn from adversity.

As we have pointed out, this research aims at providing elements that can help as basis in order to develop individual and community resilience in towns affected by floods in the state of Veracruz. This would be accomplished by high school teachers as significant adults through social driven belt permeated by the EES.

4   Methodology to Identify Individual and Community Resilience

The methodology used to study the factors involved in the development of resilience in teachers, as well as the recognition of community resilience from the teacher's perspective, are due to techniques and procedures inherent to quantitative research. The categories of this research are related to the previously identified factors. Five categories were considered for individual resilience, each with their own variables:

1. *Work environment*: social bonds; understanding, involvement and acceptance of school rules and policies; peer interaction's; opportunities for training that favour their educational practices; recognition and appreciation of their work in the community; recognition of places for initiatives within the school.
2. *Around the "I"*: (a) (I have) I have people with whom I can trust to and appreciate me; I have people with whom I can count on before an adverse situation; I have people from whom I can learn correct behaviours. (b) (I am) I am a person for whom others feel appreciation and affection; I feel happy when I do something good for others; I respect myself and respect others; I am sure that everything will be fine; I take responsibilities for my actions. (c) (I can) I talk about things that trouble me; I seek the way to solve my problems; I constantly reject the activities that could be dangerous; I look for help if I need it.
3. *Family*: levels of cohesion, communication, organisation and cooperation for daily activities and adverse situations.
4. *Significant adult figure* (self-recognition): to model behaviour; to support when there are problems; to create an atmosphere of respect and collaboration; acceptance by students and family.
5. *Health and physical conditions:* chronic diseases; frequency of common diseases; type of food; participation in sport activities; identification of overweight.

In regard to the identification of the community resilience of three towns mentioned before, whose perspective comes from high school teachers, six categories were considered with their own variables, which are related to the factors mentioned before:

1. *Collective self-esteem*: there is pride for being part of the community; satisfaction for the place where someone lives.
2. *Cultural identity*: the individual participates in local traditions; he/she celebrates local festivals; he/she shares the ideologies of majority of his/her neighbours (religion, politics, and entertainment).
3. *Collective honesty*: Appreciation of his/her neighbours and local authorities' honesty.
4. *Reflection from experience of others*: there is a reflection on the degree of damage suffered by one person compared to the one suffered by others most affected.

5. *Social humour*: Appreciation for sense of humour.
6. *Significant institutions*: level of student's meaning about school; level of community's meaning about school; identification of significant institutions in the community; participation in significant institutions.

With all these parameters using a range of 48 items, a survey was integrated. The 90% of these items are dichotomous and are related to individual and community resilience, although social aspects are also investigated in order to identify the participants. In this sense, the sample of participating teachers was established by the confidence of the study that is 90% with a 10% margin of error.

The instrument was subjected to a pilot test with high school teachers of the town of Juchique de Ferrer in Veracruz, a place that has also been affected by tropical cyclones. The collected data was considered for Kuder Richardson reliability test with a value of 0.81, which means that it is a reliable instrument (Campo and Oviedo 2008). The application of the instrument in the field work did not have complications, which allowed involving more subjects than the established in the sample. As well as, the collected data was submitted to Kuder Richardson test, resulting in reliable values in all cases.

The study of individual resilience was applied to a representative sample of teachers from the four schools mentioned in Table 1. However, the identification of community resilience was only made from the perspective of teachers since it was not possible for lack of time and resources to expand research to representative samples of populations in each municipality. Knowing of the first source the community resilience of the municipalities may be of interest for future research.

With the purpose of firstly generate frequency tables that allowed the description of the results, the collected data were introduced in the SPSS program. The progress of this research is currently in this point. Afterwards, combinations of results will be made to find correlations, in order to define better the findings and conclusions.

Table 1 Field work

Town	High school's name	Total population of teachers in high school	Sample established	Participating teachers	Kuder Richardson result
La Antigua	Agustín Yáñez	42 teachers	27 teachers	28 participants	0.86
Tlacotalpan	Avelino Bolaños Palacios	21 teachers	17 teachers	18 participants	0.82
Tlacotalpan	CBTIS 35	26 teachers	19 teachers	20 participants	0.80
Cotaxtla	Telebachillerato Cotaxtla	9 teachers	9 teachers	9 participants	0.82
	Total	98 teachers	72 teachers	75 participants	

Source Author's own elaboration based on field work

For this analysis, descriptive statistics was used with the procedures: counting and percentages. Each item was designed to indicate whether or not it contributed to the development of resilience. The answers provided elements to know the state of each one of the variables and the sum of the answers allowed identifying the individual resilience of the teachers and we approached to know the community resilience of the towns.

5 Outcomes. First Approaches to Individual and Community Resilience

The results of individual resilience indicate that there are categories with poor participation in their development, such as: *work environment* and *health and physical conditions*. Despite the fact that teachers have the opportunity given by directors for training and improve their educational practice, in all cases it is evident that *work environment* is not satisfactory; teachers also point out that their work is not recognised inside and outside the school. In addition, with divided opinions, teachers affirm that high school's rules do not apply equally to all teachers and besides this; there are no places for making work suggestions that could complement the school curriculum.

In regard to *health and physical conditions* category, the results are divided. In high schools from Cotaxtla and La Antigua, three of five items were positive, although in two high schools from Tlacotalpan, three of five items were negative. Let us remember that overweight is one of the items investigated in this research, where all the cases were negative, finding this problem as crucial to other health and physical problems. Hence this category weakly contributes to resilience in two high schools (Cotaxtla and La Antigua) and in the other two high schools this category does not contribute to the development of resilience.

Health and physical conditions represent individuality what gives it advantages over other categories. The improvement of health and physical conditions, placing overweight as a crucial subject, will greatly depend on the teacher himself, this is the reason, and so the attention goes directly to his/her work.

The categories *around the "I"*, *family* and *significant adult figure* were positive in all cases, with high percentages in most of the items. In other words, the combination of teacher's personality, attitude, support and character with the belonging to cohesive families and his/her self-recognition before his/her students contribute to the development of resilience. For example, the category *around the "I"* registered in all cases, higher percentages to 77.8%; in this regard, the *family* category averages 79.9% with positive answers among all cases; and the *significant adult figure* obtained in all the cases percentages above 80%. This information points out that the three categories mentioned here are highly strengthened and strategies could be reliably supported in them.

In regard to teachers' perception of community resilience, the *social humour* category is considered to have a high contribution to community resilience; in all cases it was positive with values above 88%. In different moments of the field work when interacting with teachers, we noticed that they have sense of humour, which is a characteristic that can transmit tranquillity effects and it helps to activate strengths before a tragedy. Being a capacity that allows defusing and overcoming misfortunes and calamities, it emphasizes strengths and helps to overcome unpredictable, illogical, unusual, and contradictory situations.

Similarly, the category *cultural identity* obtained positive results. This category places Tlacotalpan as the town with the best contribution because all items were positive in Avelino Bolaños and CBTIS 25 high schools having as result five of six positive items. The town of Cotaxtla was rated positive with five of six items and the results of La Antigua were also positive to a lesser extend having as result four of six items.

The results of *cultural identity* indicate that there are items where all cases coincide. For example, the involvement in entertainment activities, parties and local traditions are located in positive results in all cases, however, most people negate their participation in political activities (in elections). At first, the absent of participation in political activities was considered as a negative result, nevertheless the result was inverted when analysing it, because of the non-participation in political activities is a sign of cultural identity since most people shares the rejection to these activities.

The *collective honesty* category is negative in two high schools: one is located in Tlacotalpan (CBTIS 35) and La Antigua. In the other two high schools (Tlacotalpan, Avelino Bolaños and Cotaxtla) the values are divided: one of two items was positive. There is an item rated as negative in all cases which is the local authorities' honesty. In general, this category does not contribute to community resilience.

The results of the *reflection from experience* category were positive for Tlacotalpan and La Antigua. This means that teachers perceive that their community is not as affected as others. On the contrary, teachers from Cotaxtla point out that their community has been the most affected. In a section of the *resilience survey*, it is inquired whether the survey respondent teacher lives in that community or if he/she moves from one community to another; The results obtained indicate that eight of nine teachers do not live in Cotaxtla and the one who does live in the community considers that there were other most affected communities.

The previous result about the feeling of belonging to the community does not allow to describing it as the most affected. In other words, when teachers point out that their towns were not so damaged like others, it is implicit some competitiveness between communities derived from the feeling of belonging that suppress them from seeing themselves as vulnerable.

The following category is *collective self-esteem* that identified pride and satisfaction towards the place where teachers work. In all cases, the result was positive, although the percentage in Cotaxtla was the lowest what suggests that there is a correlation between collective self-esteem and reflection from experience. Eight of

nine teachers do not live in Cotaxtla but they move regularly and the feeling of belonging to the place where they live is greater than the one of the place where they work.

Finally, the *significant institutions* category indicates that teachers perceive their educational institutions as significant in their community. In this category, other significant institutions from different levels such as churches were identified. The results agree with the study made by Gamarra (2010) that indicates that these two institutions are significant for communities in Peru.

To sum up, the categories that contribute to the development of individual resilience are: *around the "I"*, *family*, and *significant adult figure*. On the other hand, the categories that required to be considered as areas of opportunity are: *health and physical conditions* and *work environment*. The results of community resilience indicate that: *social humour, cultural identity, reflection from experience* and *collective self-esteem* categories, contribute in a positive way; and the category that requires attention for being considered in the development of community resilience is *collective honesty*. In addition, the identification of *significant institutions* allows visualising links for the development of resilience. In the towns studied in this research, the significant institutions are the educational and religious.

6 Conclusions

The effects of climate change are global, however, the impacts are different in each population because of their different capacities to resist, recover and transform. The floods caused by tropical cyclones represent the greatest human and economic losses in the world and besides, some projections indicate that these phenomena will become even more intense, what represents more extreme environmental contingencies with their consequential damages.

The populations of this research have been severely damaged by floods, however they have demonstrated to have a high level of resilience. According to this study, community resilience can be strengthened by identifying and organising significant leaderships such as high school teachers. Although the results are preliminary, they help us to recognise and approximate to the factors that contribute the most to individual resilience, like: *around the "I"*, *family*, and *significant adult figure* and community resilience, like: *social humour, cultural identity, reflection from experience* and *collective self-esteem*. Also, the study allows us to identify the variables that difficult the development of individual resilience, like: *health and physical conditions* and *work environment,* and community resilience *collective honesty*.

Therefore, it is important to analyse the social components of resilience, as well as educational strategies appropriate to sociocultural characteristics of each town in order to improve its resilient capacities. The data collected will be considered in a future research in order to developing abilities that allow local residents to resist, recover and/or transform in the face of floods.

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