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Systemic Education and Awareness. The role of project-based-learning in the systemic view

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Abstract

The paper investigates the role of Systemic design[22] in a well-structured social network as a tool to solve complex problems difficult to face by the application of a linear approach. It's necessary a change of paradigm: from an approach based on the competition and on the logic of continuous growth to a systemic vision, based on the collaboration, the awareness and the rediscovery of qualitative values. The ecological emergency demands more and more the development of sustainable and resilient communities. We have to change the way of thinking processes and relations, in other words we must be ecoliterate. Infact, ecoliteracy represents the starting point of innovative processes. It gives importance to the relations and to the multidisciplinary team-work. This cultural change begins at the level of the schooling system which now represents the official institution for growing conscious individuals. The current academic system has been defined by the same linear and competitive approach used to delineate our economic systems (social hierarchy, inequalities etc.). In practice, to achieve some important changes we need to act from students of primary school to college students and over. The paper investigates also the issues of the strict hierarchy between teacher and student and the support of collaborative behaviour. In this article we present different case studies (not only from the world of academia) and analyse the role of project-based-learning in order to inspire a new eco-competent generation of people.

Keywords: *Systemic view, Awareness, Sustainable communities, Ecoliteracy, Collaboration vs Competition*

[22] Bistagnino, L. (2011), Design Sistemico. Progettare la sostenibilità produttiva e ambientale. Slow Food Editor, 2nd Edition

1. Introduction

Through the critical analysis of some case studies, this paper intends to investigate different useful tools to the "ecological education"[23]. Moreover, it aims to analyse didactic activities which have more influence in the development of an individual and collective awareness to get closer students to the systemic approach. Observed institutions represent useful starting point to evaluate how it's necessary to rearrange also the school system, because actually it's the main organization designated to provide knowledge. In the next pages positive features of case studies will be underlined to define guidelines of systemic education.

2. Social, economic and product environment

Daily activities of human life are placed inside an huge context characterized by a systemic structure. Ecosystems, which are the setting of all human activities, are made up by interconnected subsystems, in which relations and networks represent the core that define their organizational schemes. However, if we look at our economic and product systems, we can easly prove that the way used to manage their processes is very far from natural ways. With the Cartesian revolution and the introduction of the scientific method, we witnessed a rapid change of vision and a dramatic change in the way to tackle complex issues. Moving away more and more from the holistic view, people think that the behaviour of living systems can be investigated like machinery.

Firstly, from the second industrial revolution, western societies have greatly modified the pace of own evolution, moving away more and more from natural cycles of development. Then, from the Second World War, the technological progress is increasing constantly and also it leads the economic, industrial and socio-cultural time. Greater is the speed of technological innovation and greater is the request of quicker production times and more efficient travels. The immediate impact of this uncontrolled acceleration, in all fields of industrial and post-industrial society, is the exponential evolution of its material culture (Thackara, 2005). The industrial society is following the principle "it is faster and it is better" and it achieve a pace not more supported by natural cycles.

The main need of people is the interaction with natural environment, modifying it according to own demand: so design is the essential source of human life, it's the foundamental action of all human being (Papanek, 1971). Nature designs constantly living systems and it rearranges structure and relations to adapt them to new conditions and to mantain them around a balanced equilibrium. Unlike living systems, our economy faces complex problems using a linear approach and "unsystemic" vision, typical of production systems of XIX and XX centuries. This kind of vision considers only one way to solve problems, it suggests preset solution, recommended like the only one able to recover an instability. A critical situation is considered like a breakdown of working machineries: we have to solve this breakdown as soon as possible, using all kind of instruments, but without looking into the real causes and behaviours that could have generate that situation. The main inclination is to reduce all complex systems in elementary parts, in order to modify working principles of each parts, without considering relations between different subsystems and between them and the context. The unavoidable consequence is the loss of worldwide vision and the importance of connections, which are essential requirments of systems. It seems to be progressively evident that frequently the real motivation of all problems is the exclusive application of linear approach in all field of everyday life, producing consequences on ecosystems, which are more and more visible and even less foreseeable.

[23] "Ecological education" refers to a trans-disciplinary approach used to increase in students the awareness around sustainable development (UNESCO, 2002).

Also the management of natural resources is designed along a linear model, in which raw materials are extracted more than enough, are transformed through unsustainable processes without cosidering their ecological footprint, are used and finally discared in the environment. But it's difficult to reintroduce them into the natural cycles without suffering damages more or less reversible. Like industrial production, also the consuption model is conceived and spreaded in linear way, in which the consuption of ephemeral goods is intensified. Since the 1970s people started to questioning the economy itself and the political behaviour in relation to the ecological issue, but only in recent times the environmental matter has started to get consequences on the industrial project and design culture (Tamborrini, 2009). If it is true that "the 80% of environmental effect of our goods, services and facilities is defined at the design step" (Thackara, 2006), the design world should become aware to the ecological issue and it should rethink processes to reduce their ecological footprint. We have to modify our behaviour before that the project is at the operative step, so it is necessary to develop a design culture that consider the ability of human systems to have an effect on other ecosystems.

3. School, university and cultural system

Culture is the main feature of human life that explains better than other all aspects of a specific historical period. Therefore we have to reflect about the ways to reproduce it and to impart it to other people. Nowadays culture is considered and leaded like an ordinary output of the industrial society. We are living in ages marked by a lot of changes and governaments of different countries consider the education like an instrument of competitiveness that distinguishes a nation from another. They want to educate a huge number of people using less as possibile amount of resources. So they set up a real education market inside which culture is exploited like goods able to enrich the governament. Schools and universities have the main purpose to spread culture in all classes of society, they must give to the people instruments useful to integrate them into the community. Education should set people in the condition to understand the features of the context and to be aware about the decision-making. For this reason education represents the instrument of people's freedom: educated people are free to uderstand what is going on around them, free to think and reflect and finally free to express their opinion about a common topic. Nowadays we often confuse education with a basic learning of technical concepts, which are useful in ordinary jobs but they don't help to develop a critical and holistic point of view. Formal education spreaded by schools and university often seems like blocked by the huge amount of subject: students have to learn a lot of disciplines in very brief time and this kind of learning doesn't give enough time to develop critical and "meta-cognitive" abilities (Illich, 1971).

Education is one of the most important moment in the human life, not only professionally, but also individually. The typical speed of our time, in which periods are strained to obtain the most profit, has some effects also in education. Like other aspects of human life, the education system is designed using the linear approach, so it draws a rigid and hierarchical structure that reproduces the same pattern of society, based on competitives and unyaldings classes (Bourdieu, 1970). The huge list of essential abilities represents a way to control students, because they have to learn them in schedule and it also contribute to increasing the stress of daily life. This stress is the consequence of an overloaded system, which very often seems like a "knowledge factory". Inside this factory the productivity and the quantity are main topics and its first purpose is to obtain a number like merit: in this scenario the educational path loses its important sense. Especially in Bachelor degree, Masters and PhD we can notice that there is a tendency on focusing the attention on a single field of study, it asks that students have very detailed knowledge, but at the same time they lose the ability to connect topics of different disciplines.

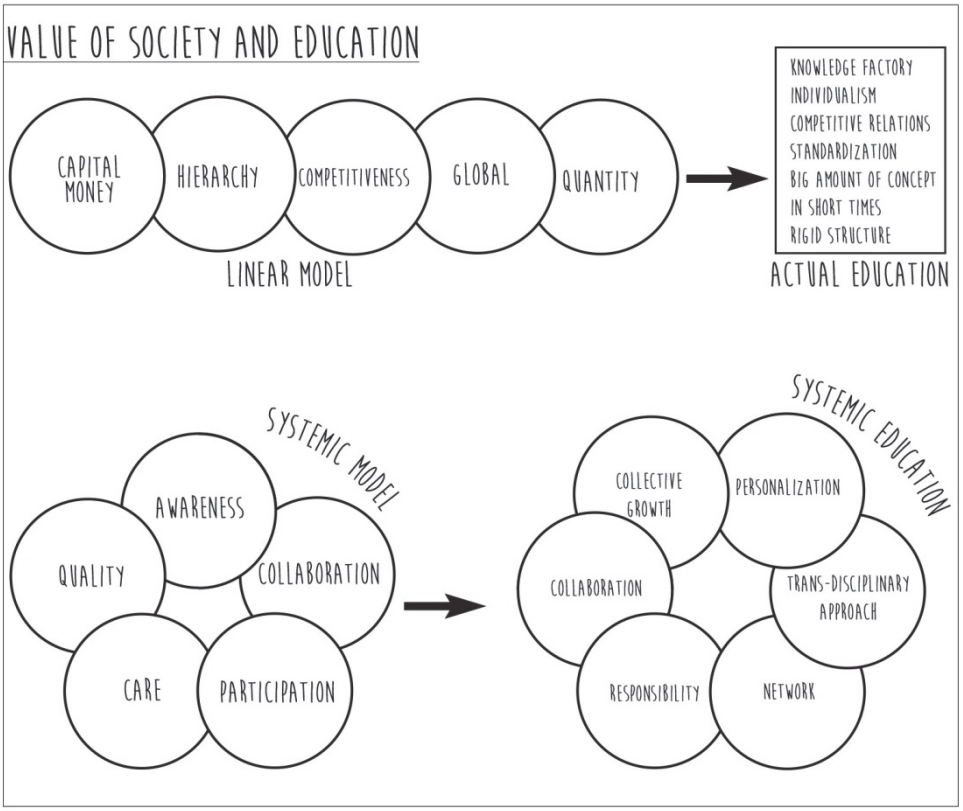

Fig. 1 Comparison between values of linear and systemic model and their consequences on education system.

4. Comparison between linear and systemic model

Looking at the ecosystem's organization, we can learn that all subsystems are interconnected and they are working in collaborative way. A very important role is represented by relations, because they set up the network in which the informal communication and sharing abilities take part between different components and also they contribute to the training of common knowledge. If we compare this mode of operation to the one of human activities, we can easily notice that they are not interconnected and they don't collaborate between them, namely they have a lot of trouble in creating a cooperative network. The main motivation of this gap between human and natural field is due to their opposite systems of values. Ecosystems follow the principles of systemic thinking to organize their structure, which is based on relations, on collaboration and on the quality of their trading and products. On the other hand human activities are the implementation of the linear paradigm and their fundamental values are very far from the systemic view. The linear society is marked by a strict hierarchical structure and competitive relations, used to achieve a dominant position on other people: the wealness of each person is not due to the wealth society, but it is the consequence of aggressive behaviour adopted to achive a position of economic power compared to other people. The only way to obtain the success is proving to be better than others, using own abilities to achieve an exclusive individual benefit without sharing them with the community. Often the only one aim of relations and tradings between people and companies is the accumulation of monetary capital, which is represent the driving force of the local and global economy. The same economy that imposes a pace following the illusion of an illimitate exponential growth (Capra, Handerson, 2009). To satisfy this constant request of growth by the marketplace, the product system reacts focalising the attention on the mass production and on the number of goods, at the expense of their qualitative values. In this way a standardized production model, which is based on the huge number of products, is adopted like

the only one possible with the aim to preserve the perception of an ephemeral and material richness. Technological development is exploited like the main motivation to plan the obsolescence of industrial products, in such a way that industrial production always replies to superfuous needs of the marketplace. All of these things contribute to the creation of a "Kleenex Culture" (Papanek, 1971) and our ecosystems are not anymore able to support this kind of throwaway culture. The main aim of the hierarchical and pyramidal structure of our society is the accumulation of huge amount of money in hands of few people through the maximization of the profit in more and more brief times. The economy is mainly interested to cash flows and to financial transactions, without considering the real wealth and the capability of systems to react in front of a critical situation. Following this linear development model, our global society has led to a rigid and fragile economic system, which is not able to re-organize itself in an efficient way after a disruption which has changed its balance. At the same time the uncontrolled exploitation of resources and the overproduction of waste have an effect on the environment and they cause a reaction so much violent and unpredictable that escapes more and more often from the human control. The linear cultural paradigm gives us suggestions and interpretations of society which aren't anymore able to satisfy real needs and at the same time to give attention on the natural ecosystem's wellness. We can notice especially in the agriculture and energetic sectors how nature and society are following two different paces: the second one is consuming more resources than the first one can produce them (Thackara, 2006). Ecosystems send a very strong message to humankind in reaction to this exploitation: it's not possible to think and effect anymore on the basis of an hypothetical illumined growth, when available resources are limited. So, nature reacts reducing the amount of available resources and showing in a more emphatic way the consequences of human actions, which cause ecological impacts more and more devastating and that effect unavoidably the financial system (Heinberg, 2011). Just as psychological consequences are evident on people's health: more quickly the economy increases and expands itself and stronger is the perception of heaviness in daily life. The time acceleration in all daily activities (job, relax time, family time...) effects like a spinner on the exponential development of material culture, linking the human nature to the concept of heaviness (Calvino, 1988). For these reasons it's necessary to change the approach used to take on different aspects of human life, we need to change the prospective from whence we are looking at things of our society. In other words it is necessary a change of paradigm from linear to systemic. We are aware that the actual situation needs new tools to understand new conditions and to decide how intervening in the future. So we have to learn a new language that allows to read and to understand consciously the complexity. This implies a change in the culture and in values systems that lead the human behavior.

5. Sustainable communities like organizational model for the future

The ecological urgency encourages the transition from actual settlements into sustainable communities. Nowadays the real challenge is the creation of resilient communities based on the examination and comprehension of natural systems (Capra, 2014). So we have to redesign processes and relations depending on resilience, just like that systems are able to modify their structure to adapt them to new conditions defined by flows and new balances into a complex scenario. Community represents the best expression of "democracy", inside which different part contribute to increase the decision-making power and the freedom of speech of its members. The attention is focusing in particular on some principal aspects of communities: the economic and decision-making autonomy, the ability to reproduce themselves without any external aid and the network like structure (Bookchin, 1989). The same concept of community suggests an important change of values: inside a community members establish relations based on trust, on awareness and on care for other members. Relationships and exchanges are directed to

put in sharing material goods, knowledge and ability with the purpose to maintain the comfort of the same community. Collaboration is the most important features of all activities inside a community and it has the aim to support and keep a dynamic community. The success and the realization of each person is not based on individualism, but on cooperation and sharing. Therefore people have an active role in the context, they try to act in a sustainable way on the environment and also they try to establish a constant relationship with it. Another important features of the ecological systems is the preservation of the community itself, that finds a way to be self-sufficient through internal processes and exchanges of input-output. This is so different from economy that is based on the exploitation and consumption of external resources. The modification of the cultural background becomes therefore the starting point to define a new system of values.

5.1 Ecoliteracy

To live side by side in armony with ecosystems, we have to re-organize structures, flows and relations of human systems. To do that we need to own instruments to understand living systems and to learn from them, in other words we need to become ecoliterate (Capra, 2011). It's necessary that people learn a new language and that they pass down it to new generations of youngs, because this language can help to design a communicative and exchanging network between different systems. All this requires a big effort in changing our habits and in redesigning our daily processes. However nature can suggest us a lot of examples about how manage our processes in a sustainable way. The first step in this direction is becoming ecoliterate and ecoliteracy have to become an essential part of the cultural background not only of future generations but also of politicians, of managers and of those people who have the ability to modify the environment. To notice significative changes into the society, the systemic view of life must be spreaded to a huge group of people, starting from primary school until post-university education. Rethinking education in a systemic view involves also a reconsideration of the hierarchical relationship between teachers and students, of the study plan and of the way of teaching.

So purposes of ecoliteracy are:

- to build “eco-competent” people, that are be able to read dynamics of living systems, to re-elaborate what they have learned and finally to apply it in daily activities;
- the promotion of collaborative behaviours through multidisciplinary team-work learning;
- the development of individual and collective awareness about ecological and systemic issues through the practice to represent an active role into the community;
- sharing of goods and knowledge with all members of community;
- the re-organization of all activities on the basis of local community's wellness;
- the development of responsibility toward other members and the environment;
- the creation of a huge network of exchanges;
- the deep knowledge about local flows and dynamics and their preservation.

All of this contribute to modify the actual cultural paradigm marked by materialism, not only into communities, but also inside each person. The challenge is overstepping the individualist approach, based on consumption and material supremacy and look at relationships and collaboration like resources of individual and common wealth.

“We find spiritual fulfillment in nature or by helping others. None of these pleasures requires us to consume things from the Earth, yet each is deeply fulfilling. These are complex pleasures, and they bring

us much closer to real happiness than the simple ones, like a bottle of Coke or a new minivan." (Suzuki and Dressel,1999, pp. 263-4)

This quotation wants to note how our perception is impaired about what can really give us wealth: the capitalist society suggests us to search happiness in consumption and purchase of material goods, but people can reach the real satisfaction using their abilities for community. Systemic education involves training of listening and understanding skills about other needs and also finding solutions far from the restricted material satisfaction. So it's necessary to develop abilities to understand messages sent by other people and by environment. In ecoliteracy, ecological studies are the fundamental background for other disciplines, directly related like biology and natural sciences or less related like economy, but important because it deals with the flow of raw materials. Systemic education requires a significant transition in educational paradigm: we have to open education to an ecology of mind (Bateson, 1977), involving also spiritual features of human life. Another challenge is the re-connection of the academic world to the real world, reconsidering the experience like an important moment in the educational path.

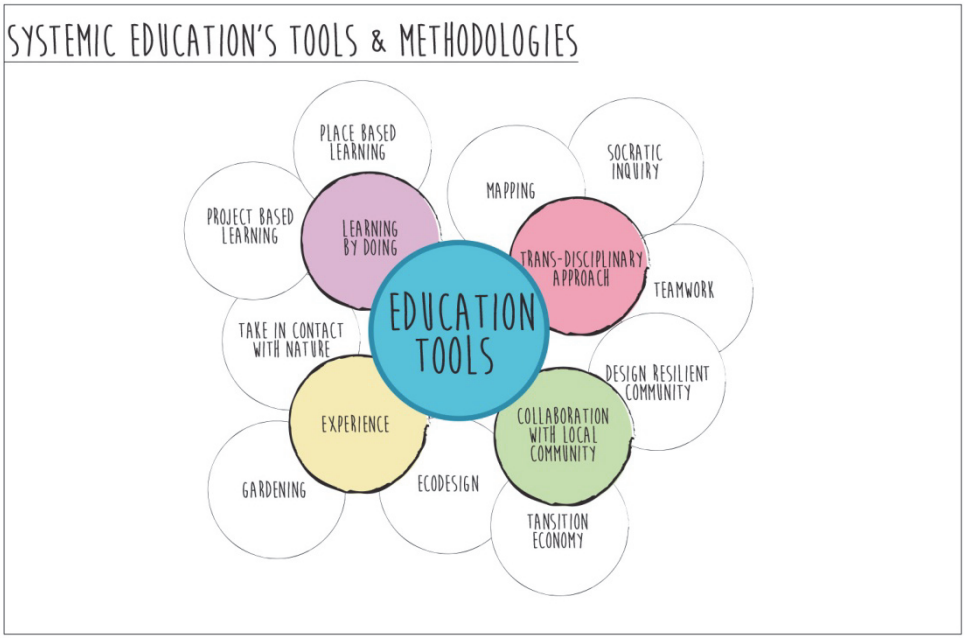

Fig. 2 Description systemic education's features

5.2 Case studies

Many projects around the world offer alternative choices to the traditional education and they consider ecology like the "fil rouge" that links all disciplines. Below some significant case studies will be analyzed, considering institutes and experts linked to ecological topics. The attention will be focused on those realities that handle the education about systemic design.

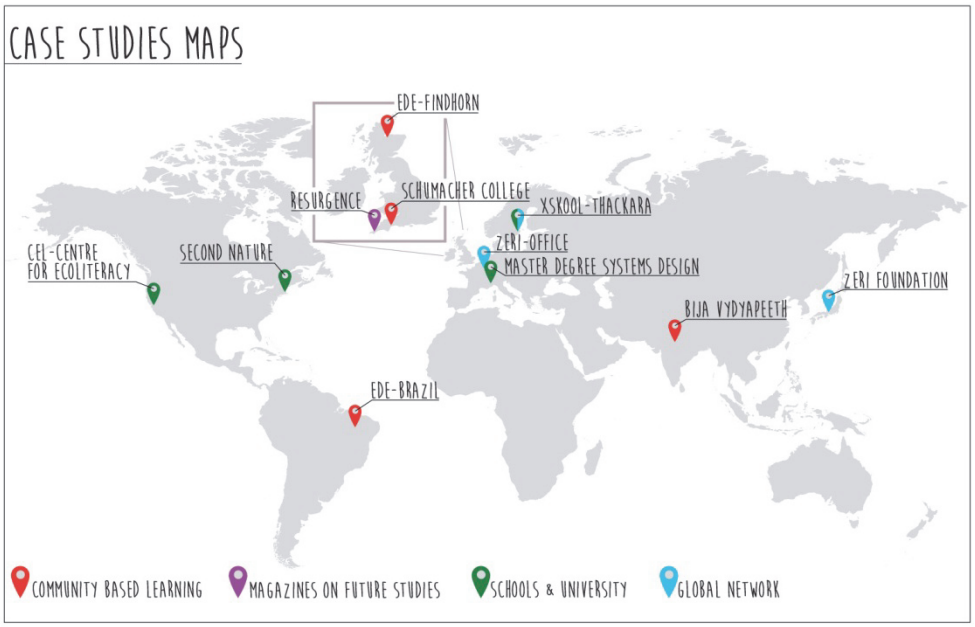

Fig. 3 Location of institutes and organization involved in sustainable field of study

We can underline a huge network of researchers and activists, involved in different project on global and local scale and moved by the intention to make people aware and to change the strict mechanistic approach in scientific studies. Between those it's important referring to the work of F. Capra, J. Thackara, V. Shiva, S. Kumar e G. Pauli. With their publications and their active role, they try to promote some changes in different fields of society. Fritjof Capra, in his books, disapproves the strict mechanistic approach in research projects and promotes the application of the holistic view in scientific fields. He also extends the network vision to all aspect of human life, from politics to social sciences. He is involved, like co-founder, in "CEL- Centre for Ecoliteracy", that promotes the ecological language in primary and secondary schools. The institution offers a systemic learning, based on the participation and on the educational power of experience. Students are led, during the learning, of principles of living system through the involvement in practical activities, like school gardening (Capra, 2014). Looking at university education, "Second Nature" (Boston, USA) promotes the ecological education working with a network of colleges in United States. They want to help college campuses into the transition to energetic sustainability. The main aim is to increase the amount of courses in ecological disciplines, to promote the foundation of new research centres, to improve their energy performance and to decrease their consumption.

Other two important exponents, linked to the ecological Indian activism, are Vandana Shiva e Satish Kumar. The first one is involved in conflicts related to the food sovereignty, the agriculture and the farmer's rights and the protection of biodiversity. She is working to make global public some problems that afflict the poorest parts of India. Important is her attention to women's marginalization and its relation with the western development model. Her position regards to the mechanicistic scientific research is highly critical, because it distances people from nature and ecological systems from human society. In India she established the "Bija Vidyapeeth – Earth University" into the "Navdanya Biodiversity Conservation Farm". It is a living and learning centre focused on democratic education, community living and protection of seed's biodiversity. The centre mainly offers courses about agroecology and organic food systems. Another exponent linked to the Earth University is Satish Kumar, activist and editor of

"Resurgence & Ecologist" magazine that give global information about ecology, philosophy, sustainable development and arts. The main purpose is to offer some alternative causes for reflection in comparison to mainstream discussions, acting on individual and collective awareness. Kumar's education is linked to Jain monks and non-violence and he represents for many people a spiritual guide. His activism is put into practice in the foundation of the "Small School" and the "Schumacher College".

Schumacher College is an international learning centre focused on environmental sustainability, trans-disciplinary and holistic learning. It works together with the Plymouth University and the Transition Network (Totnes, Devon, UK) and it proposes short and post-graduate courses, by accepting students from all parts of the world. So there is a multicultural place of study and teachers adopt community learning and "learning-by-doing" approach in educational activities. Students are divides in teamworks and they get in touch with complex theory, dynamic systems theory, biomimesis, permaculture, ecological design thinking and economy for transition. Practical experience, like gardening, and living community are considered like central moments in the learning path and in the development of ecological awareness. Educational activites include democratic involvement, sharing ideas, moments for individual reflection and practical works useful for the community.

Near to the Schumacher College is the "EDE- Ecovillage Design Education" (EDE), organized by GEN-Global Ecovillage Network and by Gaia Education, promoted for the first time in 2005 at Findhorn Ecovillage in Scotland. Every year a lot of different courses, about sustainability, are proposed in different places around the world, especially in South America. Educational activities take place into "living and learning centres "and they are organized in theoretical lessons, practical activities, workshops, project-based-learning and games, used to teach ecological principles. They propose flexible programs to adapt them to different scenarios like intentional urban and rural communities or colleges. They also apply an holistic view to sustainability, ecology, economy and social studies. Spiritual field is very important in EDE, so they propose to follow a healthy life style and to practice a daily exercise program (like meditation). All of these aspects can be useful to re-connect each person to other people and to the context.

Other two important exponents are the British theorist of design John Thackara and the Belgian economist Gunter Pauli. In different ways they get closer to sustainability and in particular to systemic design. Thackara in 2000 founded "The Doors of Perceptions", an international network of designers, innovators and students joined together in the research of solutions for a sustainable future. So the network is a real community of practice, in which ideas and knowledge are shared during meetings and workshops. They discuss about the role of technological innovation and which kind of benefit it can offer to future societies, they also talk about networks inside cities and local business. Thackara affirms that the cultural change have to start from the bottom part of the society, from common people that involve themselves in local business to promote the territory. It is very importan because "local realities compose the global one" (Thackara, 2012). He also suggests to focus our attention on relationships, because we can realize sustainability, that often is a more theoretical concept, in them.

"In nature, waste does not exist and there is no unemployment. Everything have a role into the system and outputs of an activity become inputs for another one". (trad. G. Pauli, 2010)[24]

As Thackara, Pauli suggests to focus our attention on relationships and to consider them like basis of the re-organization of our economic and industrial systems. Through the international network ZERI, composed by economists and other experts, Pauli proposes to reorganize our business in "open systems",

[24] "In natura non esistono disoccupati e neppure rifiuti. Tutti svolgono un compito e gli scarti degli uni diventano materia prima per gli altri". Pauli, G. (2010). Blue Economy. 10 anni, 100 innovazioni, 100 milioni di posti di lavoro. Edizioni Ambiente.

in which the output of an activity can become the input for the generation of other interconnected activities. Main instruments to realize this network are the biomimesis and the good knowledge of local features.

Near to the "Blue Economy" of Pauli, we can find the Master course in "Systemic Design", which takes place at the Politecnico of Torino by the prof. L. Bistagnino. "Working on the territory" is the central activity of the educational path. The territory is described by a qualitative approach that underlines its features using flow maps of raw material and energy across local systems. The main purpose is to develop into student abilities of trans-disciplinary analysis and teamwork learning, that are useful to redesign our production model from linear to systemic. Educational activities are organized using the "boss-less" structure: theoretical lessons are replaces by the "learning by doing" method and by the "project based learning". The professor plays the role of "mentor" and he gives the possibility to teamworks to self-organize their educational path.

5.3. Review

From the comparison of case studies we can notice some differences and similarities in education about environmental sustainability and systemic view. All of these examples show how community of practice, relations, territory and active involvement have an important role in education path.

Some projects are more focused on spiritual education like foundamental moment in the development of ecological awareness. These activities ask to the people to share their abilities, knowledges and ideas and at the same time they have to learn from others and work with them. Practical activities and learning have the aim to encourage collaborative and dynamics behaviours inside groups.

In many projects ecodesign and gardening are used like didactic instruments (ex. Centre for Ecoliteracy and Schumacher College), because they are practical activities that connect the group of student to the context. Often ecological dimension in education is dealt with the project based learning (ex. Gaia Education), because practical involvement can build a more established awareness.

6. Conclusions

The radical transformation of the current structure of societies involves a necessary re-organization of educational system. The organization of future societies in sustainable communities requires that also people and leaderships are appropriately educated. It's necessary to take place the quantitative approach, based on a large amount of concept, with the qualitative learning that suggests different ways to apply theoretical concepts to the real life. The systemic learning of scientific disciplines uses, like didactic instruments, principles of living systems like concepts of scheme (relations), structure and processes. Trans-disciplinary methodology is very important in systemic learning: to develop holistic view is necessary to make connections between different fields of study. For this reason workshop can help students to understand how to apply theoretical notions in realistic context and also it represents the moment in which people can develop awareness about their active role. Students take cooperative behaviours and democratic involvement and their work often have some positive consequences on local communities.

Education has to be rearranged to create a network of interactions that connects people to the context and also this network can be useful to create a learning community. The aim moves from the profesionalization of students for the employment to the social education of them, through conscious development and emancipation (Freire, 2004). Redesigning education like an open system, students get to know with concepts of exchange, relations, flows and collaboration, all features typical of living systems.

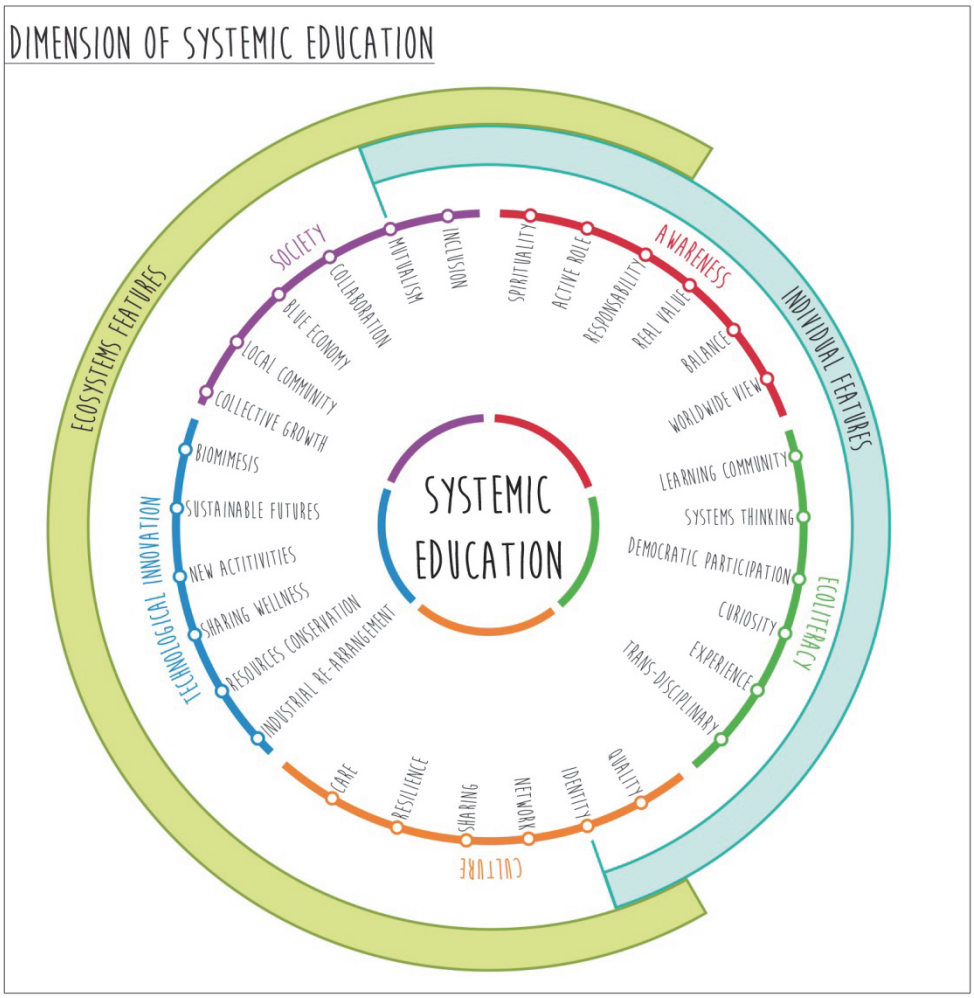

Fig. 4 Dimensions of systemic education

This analisys underlines that we are moving first steps toward a sustainable future and many of these steps are done by small realities which are working on local scale. But this transition requires that increasing ecological awareness effects more strongly on our society, through making a network between design and local economy, socio-cultural and spiritual dimensions of human life.

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