The Correlation Between Concepts of Resilience and Remote Experiment in Education

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Abstract. The role of virtual environment in relation with the resilience concept of has not yet been analyzed in depth. Educators cannot determine the resilience level of students as the trademark earned or inherited. But instead, they can create the educational conditions, enabling the resilience manifestation at higher level when the circumstances requires. The remote experiment, as a component brought in education by the virtual environment, are included in the present analyze, with them relevant benefits. The paper illustrates the fact that the problems, generated by the educational environment that aims at resilience education, are partly satisfied by the virtual environment qualities. Was succeeds to illustrate that the virtual environment (remote experiment) might contribute at resilience level increasing.

1 Introduction

The virtual environment has introduced in education new pedagogical tools and technologies. Their role in relation with the resilience concept [1–4] has not yet been analyzed in depth. Among the new tools and technologies introduced by the virtual environment authors chose the remote experiment. We will try to clarify its position in the frame of the current theories of resilience education [5–8] so as to reveal whether or not have a useful role in the process.

The issue of resilience, in the real environment, consists in the identification of resilient students and non-resilient ones using a series of factors [9, 10]. Prior to speak about these factors, firstly there is necessary to clarify the concept of resilience. Resilience includes processes and parameters designed for limitation of negative responses of students faced with three categories of phenomena (Masten, Best and Garmezy 1990) [11]:

- those regarding the differences existed between students put in front of a rapid recovery after educational traumatic effects;
- those regarding the obtaining of some unexpectedly good results in spite of negative predictions determined by events with educational risk;
- those regarding the manifestation of special adapting abilities in conditions of educational stressful situations.

The new approach regarding resilient themes in education stressed the need to consider the resilience as a process and not as a result. The authors accepted this approach in

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the present analysis as a main starting point. This approach has revealed that the resilience in education must be analyzed not only in class or inside of the groups of students. It must be viewed to cover the whole range of possibilities using three levels:

– the individual level;
– the community level;
– the institutional level.

If educators cannot determine the students resilience level as the trademark earned or inherited, they instead can create the educational conditions enabling manifestation of the resilience at higher levels when the circumstances requires. The remote experiments, as a component brought in education by the virtual environment, are included in the present analyze, with them relevant benefits.

2 Resilience and Remote Experiment as Related Processes

Resilience viewed as a process, must be defined as the ability of an educational system to adapt permanently to the environmental changes so to ensure its functioning without affect fundamental characteristics (Manyena 2006) [12]. If we refer at the educational environment, it is recognized that it is conservative and that requires long periods of adaptation at the changes manifested in the socio-economic environment. The virtual environment appearance has changed this approach. In the education, the virtual environment plays the role of a dynamic component that responds quickly at changes occurred in the socio-economic environment. If at the beginning of the interpenetration of the mentioned two media - educational and virtual - the influence of the last may be neglected, today this it is no longer possible. The duration of the knowledge renewal rate was reduced and the vector that carries renewal there is the virtual environment.

Drawing a picture of resilience (as a process) components, is possible to analyze the remote experiment dynamic support in relation with these components. We can see that the above reflects the reality (Table 1):

Table 1. Resilience components reflected in remote experiment

Nr Crt.	Components of resilience (as a process)	The resilience components reflected in the remote experiment design
1	Accepting the fact that educational systems must teach the student to work in **conditions of uncertainty** knowing that changes are inevitable in any process	*Remote experiments include intrinsic changes. These are generated by the endowment level of universities,(that is strongly reflected in the experiments level), by the level of the prerequisite knowledge of experimenters (as a consequence of the level of the graduated), by the speed of the Internet connection used, etc. All above means that the virtual environment itself contains elements of uncertainty determined by the modality of the remote experiment platforms building process*

(*continued*)

Table 1. (*continued*)

Nr Crt.	Components of resilience (as a process)	The resilience components reflected in the remote experiment design
2	Building the concept of educational resilience on the base of **diversity concept**, that means the multiple options offer for achieving the same objective. So is allowing easy adaptation to disturbances and is offering the minimization of the risk	*The network with remote experiments contains conceptual diversity. For the same phenomenon there will be multiple options for experiment implementing so that, will be satisfy the concept of diversity*
3	Contacting as many **types of knowledge** through exchanges, creating platforms for presentation of all existed surveys in educational environment. It will stimulate learning and innovation and will provide good ways to be followed in situations of crisis	*Platform(s) for presentation of all remote experiment solutions existed in the field. Any customer have the possibility to choose a path in these platforms so that the adaptation at change will be easy*
4	**Reorganization and renewal** are essential parts of natural cycles of change. Education institutions and academic communities must develop own strategies to put them into practice	*Platforms with remote experiments are so dynamic due the permanent embedding of the latest achievements from anywhere in the world. This embedding formed the pillars for strategies of change*
5	**Quickly adaptation** to the change ensured a dynamic educational environment. It is prepared to provide new answers and new educational buildings. For this we must pay particular attention to the self-organization process	*Remote experiment can be simple or very complex. Usually, the networks with remote experiments, covers all stages, from simple to complex, due the diversity in equipment and knowledge of those who compose them. A network of remote experiments or, access to multiple networks provides an attainable higher purpose. The decisions about the route between variants belong to the student, and this reason introduces a kind of self-organization process*

The data presented in the Table 1 illustrates the fact that the educational environment that aims at resilience, are partly satisfied by the elements of the virtual environment represented here by the remote experiment.

3 Education at Risk, Practical Principles

Virtual environment, represented here by remote experiment, acts directly on the student (the individual level) and also directly on the class (the community level). It introduces explicit practices of education at risk/change, as can be seen in Table 2:

Table 2. Remote experiment contribution for education for risk improving

Nr. Crt.	Practical principles for improving education for risk/change	Contribution of remote experiment
1	**Knowledge**	*In comparison with institutions immobile curricula (kept fixed between two processes of accreditation) remote experiment, offered by networks, offers to the students a diversified knowledge because these experiments reflect directly the differences between curricula existed in the world. As noted in Table 1. diversity is a powerful weapon to adapt at risk (resilience)*
2	**Different cultural backgrounds**	*Platforms with remote experiments reflect different cultural backgrounds. The students, in contact with these different cultural backgrounds, are in touch with different principles of life and education, which represents a very good way to increase resilience*
3	**Enriching the technical and technological knowledge**	*Remote experiments are created in environments that reflect the technological and technical level of universities (communities). Platforms with remote experiment will illustrate this diversity. And is well known that the diversity offers to the users necessary skills for adaptation at risk*
4	**Collaborative learning and instructional conversation**	*The remote experiment is collaborative due its content.* ***First,*** *in the virtual environment, experimental works requires, to compensate any existed gaps in knowledge, interaction between disciplines.* ***Secondly****, since remote experiments include theoretical notions, hardware and software used will reflects the manner of thinking. The students who will use these remote experiments are obliged to be in line with this manner of thinking. This alignment can be done only in collaboration manner with learning through instructional conversations*
5	**Learn to approach decisive actions**	*The remote experiment does not act in adverse situations. It support with the experiments theoretical courses. The theoretical material changes some times faster than its practical support. So, the remote experiments, offered in dedicated platforms, will serve only partially to the course goals. Decisive action, in this case, is to design and develop new remote experiments, in line with the new theoretical content. This decisive action is difficult because it often cannot be accomplished by one person. It need*

(*continued*)

Table 2. (*continued*)

Nr. Crt.	Practical principles for improving education for risk/change	Contribution of remote experiment
		establishment of collaboration between multiple users. This aspect of the collaboration is beneficial, from the point of view of resilience, because it meets with the requirements of the above 3 and 4 paragraph
6	**Use a positive way to evaluate yourself**	*Remote experiment does not answer at this principle. To be fulfilled, the designer of the remote experiment must be approach it in deliberately manner, offered so an experimental setup which increase student confidence in own practical abilities*
7	**Look at things in the long run**	*Remote Experiment does not respond to this perspective*
8	**Work with a positive outlook on things**	*Remote experiment does not respond at this requirement*
9	**Use any opportunity for self-discovery**	*The vulnerability in the face of remote experiments is linked with the gaps in knowledge (software and hardware). Instead maneuver to quit the experiment, the student must work to complete its knowledge at the level required by the remote experiment. In this case is possibly that the student to become, in time, a designer of some other similar experiments*
10	**Take care of own needs**	*Remote experiment to not meet this prospect*

The Table 2 data analyze, shows us that some methods applied in the real world, with the goal to increase resilience in education, have not correspondence in the case of remote experiment as representative of the virtual environment (pos. 6, 7, 8, 10). As a result, the design of remote experiments with the purpose: *education at risk* needs to be focused towards introduction of an environment that enhances resilience. For this, the designers of the remote experiment must be taken into account three design patterns as you will see in the following:

4 Templates for Experiments Design to Increase Resilience

The compensator model: (Donald, Lazarus and Lalwara, 2002, [13]), has the main goal to neutralize the effects of possible risk factors. Risk factors in education can be created, for example, by the sudden change of rules in academic year graduation or by the sudden change of the rules of admission. In the case of graduation rules changes, remote experiments should be targeted mainly at experimental supporting of the

generally valid theories that are not affected by changes in curriculum, and that allows rapid adaptation to the new environment. In the case of rules of admission changes, prerequisite knowledge should also refers at universal laws. The education based on the universal laws gives to the student the feeling that, no matter what changes in the system will be happen, their knowledge will ensures the minimization of the risk factors.

The challenge model: (Cook and Du Toit, 2005, [14]) has as the main goal education of accepting small failures. In the frame of this model, remote experiment will be designed with variations of paths, some of which lead to failures (e.g. wrong experimental results) and only one correct version. Thus the student gets used to the idea that some ways of investigation may lead towards failure and that perseverance leads to success, fact that well prepared him to be adaptable at risk.

The protective factors model: (Friesan and Brennan, 2005, [15]) has as the main goal encouraging the interactive process in which the student is introduced together with a protection system (i.e. a system that has included human factors as tutor, teacher, chats). Protection systems, incorporated in the remote experiments at the stage of the design, alerts whenever the student take a wrong decision (which can lead to failure). This method minimizes the risk on the one hand. On the other hand, students will become dependent by the external actors of correction. The most important protective factor in the remote experiment is that who allows avoidance of the difficulties introduced by language (hence the importance of human factors mentioned above). Most remote experiments networks are built using the English language. For this reason at accession, risk factors may occur in reading, writing, comprehension, etc. This part of the remote experiment must to be carefully designed because the language difficulties can lead to rejection reactions, which cancels the effects of increasing resilience tracked through experimental practice.

Continuing the idea of the resilience as process approach, is obvious that, the education systems based on experiment, must developed based on four components. These components were arises by the fact that the education process is dynamic, and that the learning based on experiment is considering both the past and the future. The virtual environment, compared with the real ones, stress the fact that it can help strengthen the dynamic functions of the education (Table 3).

Table 3. Supplementary functions of virtual environment

Nr. Crt	The component	The action in real system	Supplementary functions in virtual environment
1	**Uncertainty**	The students must be educated that changes are inevitable and that they must constantly adapt at changes	*Remote experiment offers many practical solutions for the same measurement. So the change is ensured by the diversity of experiments offered in the virtual environment*

(*continued*)

Table 3. (*continued*)

Nr. Crt	The component	The action in real system	Supplementary functions in virtual environment
2	**Different types of knowledge**	The student accessed platforms that contain different approaches for the same theory. So are created connections and is stimulate innovation by learning	*As stated earlier, remote experiment offers various solutions (hardware and software) for measuring the same process. In addition at this diversity is discussed not only approaches with different levels of knowledge to the same problem, but it is added the diversity of constructive solutions chosen for experiments fact that stimulates divergent thinking*
3	**Renewal and reorganization**	The student must find solutions for renewal and reorganization between old and new knowledge. This depends by the institution management. Often the old system is kept instead to be renewed or to be reorganized	*The remote experiment reflects the development in different stages of laboratories in various geographical areas. Implicitly it will reflect the levels of renewal and reorganization in the host institutions. Students have so the possibility of comparison analyses and criticism. The existed differences allows them o take conclusions, useful for resilience*
4	**Diversity**	Students must be educated to manifest multiple options. This helps them cope with perturbations and thus reduce risks	*Remote experiment offers multiple options for achieving assemblies. Diversity is an intrinsic property of remote experiments networks usefully for resilience education*

5 Conclusions

1. The paper try to illustrate that the virtual environment can contribute at increasing of the resilience level;
2. Analysis of the education components resilience, when it is approached as a process, shows that the virtual environment, represented here by the remote experiments, has additional elements that reinforce the process of resilience education. At the same time there are parts of the resilience education that are not sustained by remote experiment;
3. In education for change/risk, virtual environment introduces explicit practices, fact that should be used in an increasing manner in the teaching process;

4. The analyze regarding resilience shows that remote experiment, as a part of the virtual environment, sustain and increase the requirements, considered usefully for resilience, in the real environment.
5. Following the above conclusion in the paper are presented the design models for remote experiments that can be used to improve their the effect in resilience education;
6. The paper presented comparisons, in binomial system *real – virtual,* between the education components that provide the process dynamicity, with direct effect to increase resilience.

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