

The use of the transcendental method for helping students to learn with Logo

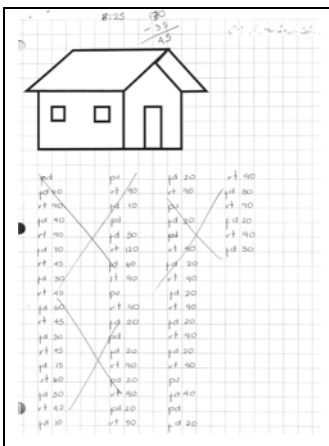
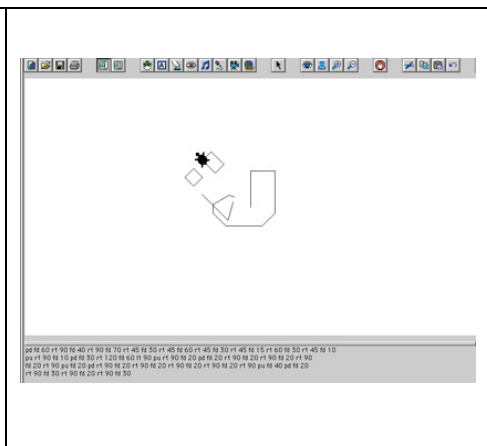

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Abstract

Planning and implementing previously designed activities can support the development a specific designed microworld. These activities must endure certain mental operations in the students toward a more meaningful apprenticeship. In order to reach this goal, in this paper is proposed the use of a method —such as the transcendental method discovered by B. Lonergan— to help students find the new knowledge more meaningful. This way the students might use this new knowledge in different areas.

In this paper, the transcendental method is used as a tool to identify the mental operations made by the student. It is illustrated with a simple example where a student must draw on paper a shape, must write the Logo code that might graphic the shape. Later the student is asked to type the Logo instructions to see if the shape was described properly. He is given time to review his instructions and find which were the errors. Finally he is asked to fix the errors and graphic the same shape.

		
<p>The original shape in paper</p>	<p>Resulted shape of her programming</p>	<p>Resulted shape after debugging her programming</p>

In order to find the errors in her programming and to construct the shape properly, the student used her finger as the turtle:



Keywords

Transcendental Method, Collaborative Learning, Meaningful Apprenticeship, Microworlds, Logo

Introduction

In this paper is presented how the transcendental method discovered by Bernard Lonergan can help structure the activities to be performed inside a microworld to help turn the knowledge into meaningful apprenticeship.

It starts with the explanation of the transcendental method and the importance on the planning and design of the activities that are going to be resolved inside the microworld.

Afterwards is suggested a “kind of questions” made for each level and some hints to develop better collaborative groups.

Brief explanation of the transcendental method of Bernard Lonergan

Beyond doubt, when a student is exposed to a teaching-learning situation there is a series of operations going on inside the student’s mind. This mental operations embrace from very simple operations —sensory— to more complex mental operations that helps the student makes a responsible decision. All this mental operations are focus toward the idea of an object and are performed by the student. He must be conscious of these operations making an “insight”, where the content is objective and conscious (Grace, 1996).

These operations occur in different conscious levels and have various intentions. It is important to distinguish each level (Grace, *ibid* p.2).

1. The empiric level is the level of the senses.
2. The intellectual level is the level of the investigation, the understanding, and the expression.
3. The rational level is the level where the student thinks and judges rationally the accuracy or inaccuracy of the information provided and makes the considerations according to his principles.
4. The responsible action level is the stage where the student applies what he knows to make a decision more accurate with what he is.

These levels are also known as of “self transcendence” what suggests that there is a group of mental operations through which the individual can transcend from the lonely being that interacts with the world beyond him to more concerning and caring being (Dunne, 2006).

These conscious operations are summarized as follows:

1. To experiment through senses.
2. To understand through assimilating.
3. To judge through thought based on rational and moral judgments.
4. To decide the ongoing action and perform it.

Also, these conscious and intellectual operations can be identified through an analysis of the objects constructed by the students.

It is important to mention that the individual transcend from one knowledge level to another; this means he cannot skip any level.

- Next it is explained how this transcendental method can support the activities designed to be used inside a microworld.

The use of the transcendental method as a support on the design of the activities created to be used inside a microworld

The constructivism is an epistemological theory that emerges from the basis that knowledge is the development of mental structures in the individual. This structure regenerates as the individual obtains information and relates it to the knowledge he already had through interaction, this way the knowledge is not discovered but constructed from the individual perspective, his particular way of thinking and his interpretation of the gotten information. This implies to acknowledge that each person has his very unique way of learning.

In order to these cognitive structures be connected with other areas of knowledge, it is necessary to make them meaningful. The knowledge of the world is constructed and reconstructed constantly through the personal experience. The knowledge is not to be given, decoded, retained and reapplied but it is a personal experience that is progressively constructed and transformed according to the experienced events.

Microworlds, according to the point of view from Hoyles and Noss (1996), can express ideas (mental objects) in a concrete way (like visible objects) allowing the computer to become as an expressive media —so characteristic in the constructionist learning environments. According to Kent (2000) Hoyles and Noss use the term “auto-expressive” to emphasize the way in which the computational environment can turn into a place where mathematical actions can be developed and thought. When these environments are carefully design —for working in a collaborative way— it is easier to create a webbing activity among different knowledge areas. To realize if the webbing is taking place, certain methods can be used to evidence the different mental actions made by the individual during his constructionist learning process. These actions (see, hear, think, calculate, etc.) are known in the transcendental method as mental operations.

The teacher can guide mental operations through previously designed activities.

These activities can also help develop a learning collaborative environment (so necessary in a microworld) working as tasks to generate a *positive interdependence*.

Teacher must visualize the moment in which these activities will be applied to students and the duration for each one.

Each activity must include questions that will help the student to transcend from one conscious knowledge level to the next one. The teacher has to consider how much the student is paying attention during his exposition where he gives the relevant information that will help the student to have the insight where the information is analyzed and understood. Once he comprehends (and builds) the knowledge he can make rational judgments upon that information and use it on his convenience. The student will decide how and where to use it. In this moment he makes principle judgments that are inherent to the human being and that can be reflected into a better collaborative group.

According to Vygotsky (1978), students are capable to carry out on higher intellectual levels when they are asked to work in collaborative situations. The diversity in terms of knowledge and experience contributes positively to the apprenticeship process. They feel more responsible of their own apprenticeship and the apprenticeship of their partners.

The number of participants for each group depends on the personality, age and interest of each participant. It is suggested that the students are motivated to work at least in pairs. Even though each student has his own materials it has to be asked to deliver only one answer sheet to develop a positive interdependence. The positive interdependence refers on having a tangible support object that forces the group to have perspective where the only way to succeed is by working as a team (Hill & Hill, 1990).

To limit the resources given is a way to create positive interdependence —the dependence among each other— because it forces the students to work together to finish the task.

The educative practice fosters this working process and the exchange of ideas in the classroom, teaching during the process, values that are considered educative by the humanity. If these values were or weren't taught is something that only the student can tell at long term and depends on attitude of the student. The collaborative learning is a situation that provokes an adequate environment. It is neither a method nor a mechanism and will only be successful when working as a whole (Castellanos & Sacristán, 2005).

As reported in the papers presented during Eurologo 2003, and 2005 as a result of previous investigations, the activities must be short (Castellanos & Sacristán 2003, 2005). It seems that when the activity lasts long, the students felt tired and disappointed, but even though the same activity was presented as a group of activities, they felt as a success when they finish each one.

The different levels of the transcendental method in the learning through Logo

The activities can be designed embracing each of the levels proposed in the transcendental method. In this part I am proposing general questions that each teacher can adjust according to the specific needs of the microworld that he or she is developing. These questions ponder the mental operations made by the student. These mental operations evolve into complexity. For a better understanding, some of these mental operations developed in each level are mentioned, such as the questions that might help to transcend each stage and the kind of answer it will have according to Rugarcía, de la Chausse and Diosdado (2005).

In order to illustrate the way a student might transcend through this method while working with Logo, in the following example each level is identified, with the mental operations.

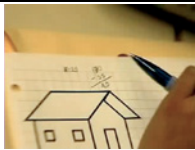

The activity consisted in several stages: during the first stage, the student has to draw with pencil in a paper a little house. In the second stage they have to write down the Logo code that he (or she) thought that will graphic the little house without the use of the computer. During the third stage the student typed the code of the second stage. On the fourth stage the student has to fix that programming to make it graphic the little house of the first stage.

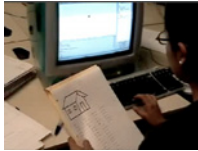
The goal is to make the student translate the description of an abstract object into Logo code, fixing it until they decided that the graphic they obtained is the one they draw at the beginning.

Sensorial level:

This level is when the student is "paying attention". It responds to the data input through the senses. The mental operations that the student makes are seeing, tasting, touching, smelling, remembering, fillings developed towards the data perceived —of repulsiveness or agreeableness— among others. The questions should be around the data. The answer will be the data that was captured by the student.


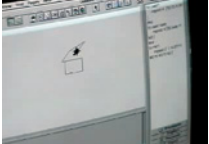
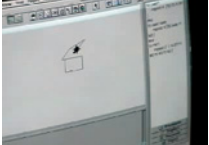
In this stage the exercises to be resolved are to guarantee that the data was input through the senses and that will be remembered.

Sensorial level		
Reads		1. The student took out the material that she prepared as homework.
Recognizes		2. The student recognizes the figure to be reproduced: the little drawing, she made, of the house.

Types		3. She typed the Logo code she thought would construct the graphic of the little house. That code was written as part of her homework, without the use of a computer.
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Intellectual level:

This level is the stage that goes from the understanding to the comprehension of the data. The mental operations that the student makes are asking, imagining, understanding, conceiving, formulating, knowing what can be done with the data, understanding what is it good for, or for what it is not that good, among others. The questions should be: what is it? How is it? Why is it? Can it help with something? It must have exercises, which results show that the student understood how to apply the data acquired in the sensorial level and comprehends (in a more profound way) when to use it. In order to have this comprehension, the student makes an insight of the data, that allows him (or her) to translate it on his or her own words, being allowed to explaining it and knowing in which situations can it be applied and in which situations it is not convenient. And the answer will be given through the insight of the data; it will illustrate what the student understands.








Intellectual level		
Compares		1. She recognizes her mistake: the graphic obtained has nothing to do with the graphic she has draw.
Analyses Decides		2. She analyzed her programming and decided to start all over again without using what she had already programmed. Also she decided to start the figure and starting in the corner of the base of the main rectangle. 2b. She started programming step by step.
Programs Executes Debugs Programs Executes		3. Whenever she made a mistake, she immediately corrected it until she finished.

This level maybe the stage in which the educators have put more attention to, but as the transcendental method establishes, in order to get to this level of consciousness of knowledge, the student must have had transcended in a proper way from the sensorial level. And it seems that we have sometimes forgotten about what comes next with that information, where the judgment rules the actions to be done.

Rational and principle judgment level:

This level is the stage where the student judges the data. When the student arrives to this stage, he or she has already the information, knows how to use it, but has to decide in a conscious way if that new knowledge is not only useful but if he is capable to use it in a good way. For example, that the student is able to compare one process to obtain an answer upon other or if the student already has an answer, to make (him or her) look for a different way to obtain it. Finally, the student will be able to decide which proposal is better. The mental operations that the student makes are thinking, reuniting proves, pondering, evidencing, and judging all the work that can be done with the data among others. The questions should be: is this that I understood the way it should be understood? Is it true? Is it not true? And the answer will be given through the rational and principle judgment of the student and will demonstrate if something was or not understood properly and if something of good can be made with it.

In order to be able to answer these questions, it is necessary to include in the activities, an exercise where it is asked for different ways to get the same answer. It is necessary to develop “debugging” as a common practice. To make the student define the facts that makes one answer better than another. These facts will help establish principle judgments that will help to make a better decision (e.g. how many lines are programmed in the procedure, how accurate it is, or if the “game” that is being programmed by the students has a negative or a positive connotation).

Rational level (of rational and moral judgments)						
Debugs Programs Executes		1. It was necessary for her to go back to the previous level.				
Compares	<table border="1"> <tr> <td></td> <td></td> </tr> <tr> <td>Graphic made with Logo</td> <td>Graphic drawn in paper</td> </tr> </table>			Graphic made with Logo	Graphic drawn in paper	2. She recognizes the figure as “the same” that she was looking for (the little house drawn by herself).
						
Graphic made with Logo	Graphic drawn in paper					
Recognizes	<pre>fd 40 rt 90 fd 60 rt 90 fd 40 rt 90 fd 60 rt 90 pu fd 40 lt 90 pd fd 10 rt 135 fd 40 rt 45 fd 60 rt 45 fd 40 rt 135 fd 20 rt 40 fd 24 rt 90 fd 15 lt 180 pu fd 15 pd fd 20 lt 30 pu fd 41 lt 101 pd fd 40 lt 90 fd 40 lt 180 pu fd 40 rt 90 pd fd 10 rt 90 pd fd 20 lt 90 fd 10 lt 90 fd 20 rt 90 pu fd 20 rt 90 fd 20 pd fd 10 lt 90 fd 10 lt 90 fd 10 lt 90 fd 10 rt 180 pu fd 15 pd fd 10 rt 90 fd 10 rt 90 fd 10 rt 90 fd 10</pre>	9. She recognizes some repetitions in her programming.				

Action level:

The student acts in consequences of the judgments made on the previous level, for it will be a responsible action. In this stage the student has the arguments to decide which proposal is better, and must argue with his partners, inside the collaborative group, the most important facts that made him consider one proposal upon another.

Action level		
Efficient	<pre>repeat 2 [fd 40 rt 90 fd 60 rt 90] pu fd 40 lt 90 pd fd 10 rt 135 fd 40 rt 45 fd 60 rt 45 fd 40 rt 135 fd 20 rt 40 fd 24 rt 90 fd 15 lt 180 pu fd 15 pd fd 20 lt 30 pu fd 41 lt 101 pd fd 40 lt 90 fd 40 lt 180</pre>	1. In the previous level she recognizes the repetitions and in this level she decides to debug her programming.

<pre> pu fd 40 rt 90 pd fd 10 rt 90 fd 20 lt 90 fd 10 lt 90 fd 20 rt 90 pu fd 20 rt 90 fd 20 pd fd 10 lt 90 fd 10 lt 90 fd 10 lt 90 fd 10 rt 180 pu fd 15 pd fd 10 rt 90 fd 10 rt 90 fd 10 rt 90 fd 10 </pre>	
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Although the student didn't make the exact shape, she decided that she has reached the goal. There are clear differences in the windows, the roof and the door. These differences were not important to her. She consciously didn't fix them. Her action was responsible.

Conclusions

There are two important facts to be consider for having success: the content must be presented as meaningful knowledge to the student (meaningful apprenticeship), and to endeavour that the knowledge is built by the student himself, that he establish the connections among the new and the previous knowledge to facilitate the transference of the new concepts to other areas of knowledge.

When applying the activities, it is important to establish the initial conditions (to work individually, in pairs or in small groups). To have control upon the data that will be provided to the students. Establish the rules for discussions and watch over all the interactions inside the microworld.

The activities must be short and designed according to any method that can provide a guide to make the student turn information into meaningful apprenticeship. The transcendental method discovered by Lonergan can do so. For each conscious knowledge level the teacher can create questions that will help the student transcend through each step. This way the activities may support with accuracy the microworld. In the next table, the mental operations were identified in each level of the transcendental method.

Level	Mental Operations
Sensorial	Read
	Recognize (the shape)
	Type
Intellectual	Compares
	Recognizes (mistakes)
	Decides
Rational judgment	Fix (the programming)
	Executes
	Recognizes (the success or failure, and thinks of the activity as finished)
	Recognizes (some repetitions and mistakes that were not determinant)
Moral Judgment	Decides (to keep or not debugging the programming)
Responsible Action	Fix and debug

References

Castellanos, E. & Sacristán, A. (2003). *Logo as a tool for introducing Fractal Geometry to students of Graphic Design*. In Proceedings of EuroLogo 2003. Edited by Cnotinfor, Lda. pp. 306 – 316.

Castellanos, E. & Sacristán, A. (2005). *A Fractal Geometry Logo based microworld for Graphic Design graduate students*. In Proceedings of EuroLogo 2005. Edited by G. Gregorczyk, A. Walat, W. Kranas & M. Borowiecki OEIIZC. pp. 23 – 32

Dunne, T. (2006). *The Internet Encyclopaedia of Philosophy: Bernard Lonergan (1904-1984)*. Consulted on August 12, 2006 at: <http://www.iep.utm.edu/lonergan.htm#H2>

Grace, R. J. (1996). *The Transcendental Method of Bernard Lonergan*. Consulted on August 23, 2003 at: <http://www.lonergan.on.ca/reprints/grace-method.htm>

Hill, S. & Hill, T. (1990). *The Collaborative Classroom: A guide to co-operative learning*. Heinemann. Nueva Hampshire, Australia

Kent, P. (2000). *Some Notes on Expressiveness*. Consulted on October 5, 2003 at: <http://www.lkl.ac.uk/come/events/weizmann/Expressiveness-notes.pdf>

Noss, R. & Hoyles, C. (1996). *Windows on Mathematical Meanings. Learning cultures and computers*. Kluwer Academic Press. UK

Rugarcía, A., de la Chausse, M.E. & Diosdado, B. (2005). *Programa de Desarrollo Integral*. Ed. UIA-P, Puebla, México

Vygotsky, L. (1978). *Mind in Society: The development of higher psychological processes*. Harvard University Press. Cambridge, EE.UU.