The Golden Fruits and Mathematics

Xaro Nomdedeu Moreno. OECOM Ada Byron

1. Abstract

This lecture shows the pedagogical effectiveness of using items from home everyday life to teach mathematics to girls. Some samples of items such are: the globes, sticks, peas, soap solutions...

In this lecture, I'll show something more about this: we can study properties of structure of the golden fruits like apples, oranges and bananas, related with the Night's daughters. With the properties studied, we can make a program WinLogo and to simulate all these fruits in the computer.

2. Introduction: Subcultures

2.1. For Gramsci and Cultural Studies (CS), Culture is a key site where struggle for hegemony takes place. In CS, hegemony expanded beyond boundaries of class to include race, **gender**, **culture**, consumerism, meaning, pleasure.

During years 1979-90, UK CS began to fragment and migrate to US, Canada, **Australia**, France, and India

In mid-80s, many disciplines moving towards a more active engagement with politics of social identity and examination of representation of cultural forms. In media studies, the emphasis shift towards ethnography of audiences, also in **Mathematics education emphasis shift towards ethnography of pupils**.

2.2. Bishop

Alan Bishop, in Mathematical enculturation, talks about Mathematics as "a way of knowing". It takes a cultural look at this supposedly familiar subject, and it analyses the educational consequences of the cultural perspective. He explores a range of anthropological, cross-cultural and historical literature concerning Mathematics and culture to create a new conception of Mathematics: the cultural values which mathematics.

He has therefore chosen, as a first level of structuring, three different *components* which he would argue are essential in an enculturation curriculum. As 'labels' and descriptions of the components he offers the following:

- *The Symbolic Component* - He has presented the case that six key 'universal' activities are the foundations for the development of mathematics in culture covering the significant explanatory conceptualisations in the symbolic technology of Mathematics, which allow principally the values of 'rationalism: and 'objectism' to be explicitly explored.

- *The Societal Component* - exemplifying societies manifold uses of Mathematical explanations, and the principal values of 'control' and 'progress' which have developed with these uses.

- *The Cultural Component* - exemplifying the meta-concept of mathematics as a phenomenon existing in all cultures, and introducing the *technical* idea of Mathematical culture, with its principal values of 'openness' and 'mystery'.

Angela McRobbie is interested in contributions from ongoing research on the boundary-setting practices of girlhood in a global frame. What are the limits of intelligibility in regard to inhabiting the category of girlhood? How might the case for the radical uninhabitability of normative girlhood or womanhood be defined within an international human rights discourse? How is the girl-as-worker located within the international division of labour?

2.3. Keitel

If we observe the investigations of the last thirty years it has more than enough Women and Mathematics, we can verify several perspective changes. In the first place, I will highlight a change in the questions that have unchained these investigations. In the beginnings, and mainly in studios of psychological type and cognitive, was the question "why the women and the girls, don't, know how to make Mathematics?" That is to say, implicitly it was admitted that the problem resided in the women and in the girls and, consequently, the causes of these differences considerate were looked for like innate: you cause biological, psychological, and cognitive in general.

Some performance programs paid more attention to the girls to the process of learning of Mathematics. These programs put of relief that the achievements of the women and of the girls in Mathematics were not so bad, but rather, simply, there were few girls that chose to be devoted to their study. Therefore, the basic question changed: "why the girls and the women don't make Mathematics?" The problem was still centred in the girls, but you already began to aim other causes: it was verified the presence of stereotypes and social influences that had counteractive effects in the girls from the point of view of the motivation.

Analyzing more seriously the motivation problems, and rejecting the existence of an only cause as absolute, it was changed the question basic of the investigations again: "why the women and the girls don't want to make Mathematics?" That is to say, the problem has transformed into a problem of teaching, a problem that concerns to the society and even a problem also of the boys. The social image of the Mathematics is partially and unbalanced and it lacks arguments so that the women are devoted to them. The results of the investigations have more than enough Woman and Mathematics have derived, because, toward the teaching of Mathematics in general. And the problem has you defined finally as a coeducation problem.

Therefore, the change of the questions has borne a perspective change in the investigations. The problem "Girls, Women and Mathematics" have become "Gender and Mathematics.

2.4. Boaler

The results from the Amber Hill and Phoenix Park case studies both support and challenge different gender perspectives within the field of education. At Amber Hill many of the girls underachieved in mathematics, they demonstrated anxiety and they were disaffected. But the girls did not 'attribute' the 'blame' to themselves. They offered coherent accounts of their desire to understand mathematics and the ways in which they believed their school's textbook approach denied them access to understanding. The girls were c1ear that their mathematical understanding would have been enhanced if they had been given more opportunity to work in an open way, at their own pace and in groups. The girls at Amber Hill were clear about the reasons for their disaffection and they supported the idea that equity in mathematics education is more Likely to be achieved if mathematical epistemologies and pedagogies are changed (Burton, 1995). This argument was given further support by the fact that the open, process-based approach at Phoenix Park appeared to produce mathematical equity.

The reasons for the disparities between the reports of the Amber Hill girls and the theories that emerged in the nineteen eighties may represent the broad societal changes that separate the eighties and nineties and that have impacted upon young women growing up. The voices of the girls were not heard in previous research studies and at Amber Hill it was the girls themselves who were most able to challenge the ideas that emerged from the nineteen eighties. Significantly, the girls replaced notions of blame and low-level approaches with ideas for equitable *aim powerful* models of mathematics that were based upon enquiry, challenge, connected forms of knowing and depth of understanding, like those of Phoenix Park.

2.5. Claudi Solar

In early mathematics, domestic tasks (weighing, measuring, and shopping) are used as a matter of course. Thus allows stereotypically feminine activities to be used as the site for the teaching of mathematics and nothing is therefore done to hinder the progress of girls. We would suggest that the use of domestic activities in early school practices provides less contradictions, for the girls at this stage of their education, than do the activities that are used to exemplify mathematics in the secondary school.

In this lecture I'll show that there are a lot of domestic objects, task and situations (or their pictures[i]) that can provide good practices for the girls in secondary school also. In particular the golden fruits, but in higher level than elementary arithmetic problems[ii]

3. The project

It shows the pedagogical effectiveness of using items from home everyday life to teach mathematics to girls. One of the reasons is that they are accessible, they are cheap to acquire, they are ubiquitous and mainly familiar and so it's easier learning maths. All these characteristics facilitate also the extension of experiences to each school and to each family. Moreover, when the students, girls and boys, came back home they have readily available all the items that are being used in school for teaching purposes, in this way it becomes an easy association of images that facilitate remembering and learning. Some samples of items such are: the globes, sticks, peas, soap solutions,

While it's up the natural sciences to unravel these laws, it's the task of mathematics to develop the conceptual tools to systematically describe and comprehend the characteristic features of the resulting structures: crystals, sea shells, flowers, fruits, etc. It allows us to study properties of structure and formation processes, and understand laws and underlying principles governing the Nature. Indeed, we can mount an exposition with some modules, in a sort time, like those of Unesco in "Experiencing Mathematics" showed in Copenhagen last ICMI

Moreover, rapid progress in me modelling of biological structures and simulation of their development has occurred over the last few years. It has been coupled with the visualization of simulation results, which has lead to a better understanding of morphogenesis and given rise to new procedural techniques for realistic image synthesis. So, computer science is being applied to study processes taking place in nature.

3.1. Apples[iii]

When the apple is dissected in the planes perpendiculars to its stern we obtain sections like torus. The apple core shows then 5 folds symmetry (D5). From these sections, we can work with the numbers Pi and PHI (the golden number).

Also we can work the concepts equality and Chirality. It is possible, though, to dissect it into a pair of two left-handed or a pair of two right-handed halves.
But, from two different apples you can produce a pair of opposites: a pair of right-handed and left-handed halves-but they cannot be combined into one apple. Orientation, this is the problem. They are heterochirals. Like a lot of elements of nature: the helix in AND, several snail's shells, the human hands, etc.

Make two vertical half-cuts through the apple one from its top to its equator, and the other, perpendicular to the fust, from its bottom to its equator. Then make two nonadjacent quarter cuts along the equator of the apple. Following these cuts the apple should split into two homochiral halves. This recipe can be followed in two senses and thus produce two left-handed halves in one case and two right-handed ones in the other.

3.2. See Shells[iv]

Special surfaces can be generated in 3D from either the scalar magnification, or rotation about an axis, of generating curves which remain self-similar throughout the process. Obviously the next step is to combine both operations together in a more general coordinate transformation
These are the kinds of surfaces about which Jan Swammerdam, in 1737, wrote

" [a snail shell] must be conceived as a certain oblong, hollow, sharp, and flexible tube, which if rolled and turned round a small iron line or wire, and afterwards this thread or line were drawn away from it, would shew such a perforated pillar [the collumellar umbilicus], which would be the more exact, if those foldings, together with their inclosures, were applied closely to each other, and fastened and united together ... and after this manner are almost all kinds of such little shelly habitations built, in whatever wonderful manner they appear to be turned or constructed. "

If we applied the rotation about the axis z, not translation about any axis and nothing about magnification, we obtain an circumference.

If we applied the rotation about the axis z, translation about the same axis and nothing about magnification, we obtain a helix.

If we applied the rotation about the axis z, not translation about any axis and the magnification the radius of rotation, we obtain a spiral.

If we applied the rotation about the axis z, translation about the same axis and the magnification the radius of rotation, we obtain a concospiral.

To obtain the equations step to step in these four faces is easier for pupils in early secondary school. A step more is to make only a program for designing all ones. You cap see the results of my pupils 14-15 years old. These little programs are the beginning for the last program I show in these lecture.

3.3. Bananas[v]

Understanding the dynamical and kinematics of the continuous fields resulting from computations and/or data has advanced by studying them in terms of their characterised geometrical properties, **the shapes of their contours** (oranges, bananas or sheets?). These approaches have clarified concepts about the flow around mountains and buildings, dynamics of inertial particles and bubbles in vortices, diffusion of clouds of particles in different types of synoptic meteorological situations We can observe the bananas saphes and sections: we can cut a banana with horizontal, vertical or oblique planes and then we can found easy some famous curves so that: Conics de Apollonius, ovals de Cassini, lemniscates de Bernoulli, hipoddedes de Proclo, spirics de Perseo, cissoids de Diocles, etc. This is an approach that approximates pupils to famous curves in history.

3.3.1. Oranges[vi]

There are different ways of peeling the oranges: according to the experts, the best one consists of cutting one little piece around the flower and another equal one in the external one diametrically opposed extreme.
poles, axis, meridians, parallels, spherical zones, segment of two bases, an spherical cap, a segment of a base, a bobbin and wedge, an spherical spiral, an hemisphere, an hemispheric cap.

In the tree, the fruits are arranged in the best way for utilizing available space with maximum efficiency: arranging points on the surface of a sphere in such way that the points are maximum distances from each other. It is basic to obtain equity for each one. In the markets, salesman and saleswomen, solve a similar problem: how pilling[vii] the oranges to obtain the maximum the oranges in the minimum space?

3.4. Golden fruits[viii]

In this lecture, I'll show something more about this: we can study properties of structure of the golden fruits, apples, oranges and bananas. With the properties studied, we can make a program WinLogo and to simulate all these fruits in the computer. It's the same program for all of them, only we should elect adequately the values of its variables. With one other step we can obtain a beautiful sea shell, this is a mythic fruit also.

3.4.1. Myth[ix]

The stories and myths are lovely for girls. The golden fruits, apples, oranges and bananas, are related with the Night's daughters and with the Chaos.

3.4.2. Program[x]

Of all they the orange is the most perfect one, therefore we can generate it causing rotating a semicircunferencia. The lemon is obtained in the same way, but the arch that revolves is smaller that average circumference, in the case of the apple is greater. From there to the obtaining of the banana there is not more than a step, therefore suffices that the circumference that revolves diminish its radio progressively. One program is enough to obtain all these fruits in the computer, only we should elect adequate the values of his variables:

Banana: 200 20 4.5 .5 .5

Orange: 0 50 4.5 0 2

Apple: 40 50 9 0 2

Bibliografía

HARGITTAI, István and Magdolna. “Symmetry. A Unifyng Concept” Shelter press. California.1994

ILLERT and SANTILLINI. “Foundations of theoretical conchology”. Hadronic press.USA. 1995

RALINA, L. Joseph. What is Cultural Studies? California. 2005

PRUSINKIEWICH,P. “Modeling and Visualization of Biological Structures”. Ontario. 1993

BISHOP, A. “Mathematical Enculturation”. Kluwer Academic Publishers. 1994

KEITEL, C. “Social Justice and Mathematics Education”. Freie Universitat Berlin. 1998

KEITEL, C. “Coeducación y enseñanza de las matemáticas. Una revision de las investigaciones”. OECOM. 1994

NOMDEDEU, R. “Mathematics in Golden Fruits” ICME 10. Copenhagen. 2004

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[i] http://w3.cnice.mec.es/eos/MaterialesEducativos/mem2000/matefoto/libro/index.htm
[ii] http://www.loders.dorset.sch.uk/HomeSchool/witches/2003-04/fruitshop.doc
[iii] http://xaro.isnow.org/premabn/publicacion/MGFapple.ppt
[iv] httm://xaro.isnow.org/caracolas/FUNCIONES%20PARA%20LAS%20CARACOLAS.ppt
[v] http://xaro.isnow.org/premabn/publicacion/MGFbanana.ppt
[vi] http://xaro.isnow.org/premabn/publicacion/MGForange.ppt
[vii] http://xaro.isnow.org/premabn/publicacion/MGFpile.ppt
[viii] http://xaro.isnow.org/premabn/publicacion/MGFportada.ppt
[ix] http://xaro.isnow.org/premabn/publicacion/MGFmito.ppt
[x] http://xaro.isnow.org/premabn/publicacion/MGFprograma.ppt