Expanding Learning Scenarios
Opening Out the Educational Landscape
Proceedings of the European Distance and E-Learning Network 2015 Annual Conference
Barcelona, 9-12 June, 2015
ISBN 978-615-5511-04-2
ISSN: 2707-2819
doi: https://doi.org/10.38069/edenconf-2015-ac-0003

VISUALITY AS A TOOL FOR EXPANDING LEARNING

András Benedek, Budapest University of Technology and Economics, Hungary

Introduction

The slowly spreading, century-old paradigm of traditional learning was "overtaken" by modern educational theories. Influenced by ICT, theorists of learning made a significant, impulsive turn, recognising the role of learning and knowledge sharing networks while still relying learning theory, instructional design schools such as behaviourism, constructivism and the newest, cognitivism. This paper focuses on a contradiction related to the subject both in an institutional and a broader context and considered a critical element of this process rightfully perceived as progressive. The relative old phenomenon recently seems renewed the disciplines acknowledge the role of visual tools in human communication and it is strongly promoted these days by ICT tools that facilitate visual communication in space and time.

Visual learning – paradox or contradiction?

More than half a century ago, in 1961, an MIT report on engineering design(Ferguson, 1994) mentions that "The real 'problem' of educating engineers is the implicit acceptance of the notion that high-status analytical courses are superior to those that encourage the student to develop an intuitive 'feel' for the incalculable complexity of engineering practice in the real world." The historic experiences in interpreting and using parables called attention to the fact that these two methods of communication as visual and verbal, do not necessarily contradict each other as educational tools. Applying visual learning in the framework we may fully utilise its potentials in creating opportunities for those who want to hand over knowledge and those who wish to acquire it.

The development of visual learning may be perceived as a parabolic situation whose theoretical and partially practical analysis is particularly important, with special regard to the above mentioned aspects. Obviously, we do not have to convince those directly involved in visual learning that images have always had a significant role in human communication. Around the Millennium "visual homecoming" (Nyíri, 2014) had an increasingly strong impact on daily communication, and through that on education, on institutionalised education in particular. The mass penetration of ICT tools brought a significant spontaneity into learning processes; no wonder it was very hard to make it compatible with the visual contents of curricula designed and objectivised in algorithms that had been in turn designed in the framework of the national curricula. The visual contents in traditional textbooks and online curricula, the latter also serving as an illustration of the actual status of the technical infrastructure, have not changed much in the past decades.

Visual learning was already known in ancient societies and not only as a tool for daily communication or daily knowledge transfer. Parables created a virtual double dimension, where short, figurative speeches could convey the meaning of an idea by using a picture or metaphor of ordinary life. It should also be mentioned here that 'parabola' i.e. the mathematical interpretation of the word parable and the relevant graphical representations are as old as the other interpretations. The similarity between the mathematical representations and the general features of the communication typical for learning situations is believed not to be incidental.

The equation $y=x^2$ does not only determine the form of the curve, but also refers to the nature and ratio of verbal and visual information provided in the curriculum for a particular learning content (hereinafter referred to as L). The amount of verbal information is plotted on the x axis while that of visual information on the y axis. In our assumption, we presume that increasing the amount of verbal information in a linear fashion results in a significant, quadratic increase in the amount of visual information for the same knowledge element. This presumption may be considered realistic, being aware of the usual text to pictures ratio in books, etc. On the other hand, it also indicates that a significant (4-fold or even 16-fold) increase in the volume of visual information only corresponds to a 2-fold of 4-fold increase in that of verbal information for any given knowledge element on the parabola.

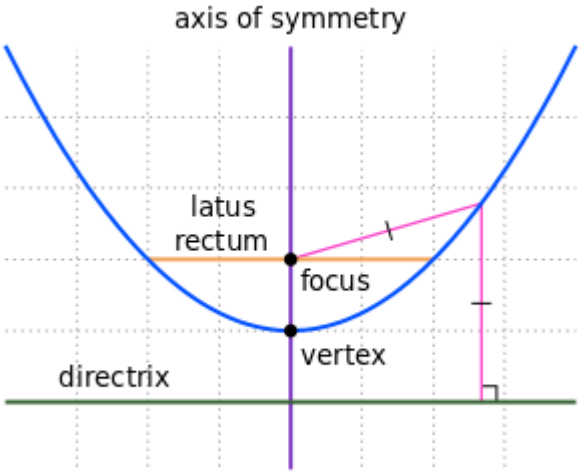

Figure 2. The classical parabola

The example emphasises that according to the equation of the parabola, for the same "directrix sections" (in our example, amounts of verbal information related to a given knowledge element) significantly more visual information is allocated (in our example, the increase is quadratic). If these ratios are altered significantly, the resulting curriculum will be predominantly verbal or predominantly visual. In both cases, acquiring knowledge will probably be severely hindered[1]. The *in situ* analysis of the history of the issue as given above and the interpretation of parabolas in communication situations has led to tackling the

[1] We may note here, that in our thought experiment the ratio of verbal and visual information for a given curriculum is only based on estimations. Though these ratios may appear to be perceivable, calculating the actual functions requires empirical studies.

ISBN 978-615-5511-04-2

practical problems of visual learning from the aspect of education. Improving the efficiency of an education system predominantly relying on verbal contents may represent a significant challenge due to the lack of the necessary time and information and the slowness of correction mechanisms in the case of traditional curricula, as it was proved by several methodology experiments as cooperative methods, project based work, connectivism (Siemens, 2005) in learning. Even "modern" curricula that had been developed by the end of the 20th century had a linear structure and the prevailing dominance of verbal contents (80% on average) was changing only slowly, giving way to visual contents which in turn were mostly composed of static pictures. Though online curricula and multimedia-based e-learning representations include more dynamic visual contents (flash, video), the "logic" of curricula design has not changed in our opinion. Visual contents are still considered as mere supplements to verbal (written and oral) messages.

An alternative to the curriculum design paradigm drafted above may be increasing the ratio of visual elements in order to increase the volume of information. However, the ratio cannot be altered just randomly. Changes should fit into the parabolic equations, assuming that both formats (verbal and visual) are required by learners and their ratio is the same for a given subject, age group and other conditions.

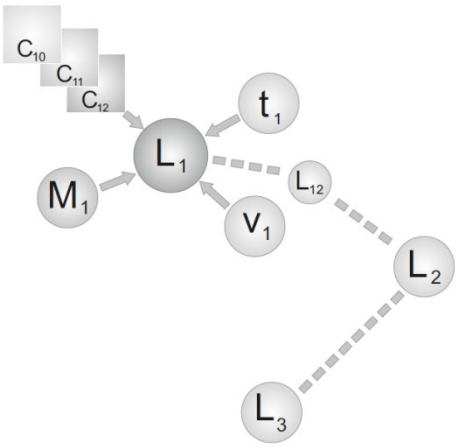

Figure 2. The schema of complex learning content net

Regarding methodological questions, with special regard to mathematics and other disciplines of natural sciences and the related applied sciences such as technical sciences and their applications, curricula are based on descriptive verbal elements (***Text – t***) that are supported by visual elements (***Pictures – V***) and mathematical formulas (***Math – M***). Traditional curricula (published in the format of textbooks) usually include the combination of these, structured in a rigid linear sequence, such as 'explanation, figures, formulation, explanation' and so on. Often random examples are only given as case studies (***Case – C***) to illustrate practical applications. Even tests to facilitate practicing follow this structure or they are provided in a sequenced order.

ISBN 978-615-5511-04-2

The visual representation illustrates the most important features of the structure as knowledge elements are organised into a system, which is independent of scale. For curriculum design developed in *open access*, cloud services offer a development infrastructure surpassing all previous solutions. So far we have used series like

t ------ ***P*** ------ ***M*** sometimes supported with practical examples ***t*** ------ ***V*** ------ ***M*** ------ ***C***

Showing other connections between these elements to develop a dynamic network was typically hindered by disciplinary and temporal restrictions.

Based on our current development and the relevant hypothesis, the new curriculum may greatly facilitate the acquisition of knowledge and its control. This new curriculum, where verbal and visual elements are presented in a one to one ratio and knowledge elements are organised into a network, would be scale-independent and structured as a graph also supported by a mathematical representation to enhance both its theoretical and practical aspects and users would be allowed to extend it by case studies and practical examples. For each element of this knowledge set formulated in the virtual space in a graph structure, a *comics* would be assigned. A comics is a solution that combines verbal and visual information as well as a mathematical representation and can be adjusted for the needs of the given age group. These knowledge elements, to be verified upon a broad professional basis, would basically summarise theoretical and general information in a modern format, yet in an optimum volume.

As a result of the open structure, the new system is obviously more suitable for incorporating new and interdisciplinary knowledge elements than traditional solutions. The parable of visual learning becomes reality at this point. The verbal dominance in the current traditional education framework cannot be overcome due to reasons like tradition, methodology culture, generations of textbooks, whereas in the new system the ***t-V-M*** knowledge structure, originally restricted both in space and "volume" may be supported by a ***C*** set of case studies unlimited regarding the number and nature of examples, where practicality and the need for illustration *ab ovo* presumes the dominance of visual elements.

Case study – implementation of a new approach

The project "E-teaching Culture and Digital Content Development at Budapest University of Technology and Economics to be implemented between 2013 and 2015 aims at developing content, methodologies and services support of competitiveness of higher education, structural changes coming from the Bologna Process and meeting the challenges of knowledge-based economies. The project rooted in the idea that the strategic goals of the University as well as those of vocational education and training presume the continuous improvement of the quality and excellence of teachers, which in turn points at the

ISBN 978-615-5511-04-2

development of a teacher-researcher attitude essentially independent of the limitations represented by subjects or faculties[2].

Our hypothesis may be summarised as visual learning may provide opportunities to use parables that are able to improve the efficiency of human learning, currently based on traditional verbal communication and as such hindered by time constraints and information pressure. Developing curricula presented challenges in the fields of digitizing, multimedia editing and on-line publishing. Meta-data structure, SCORM conversion (converting contents into SCORM format with interactive elements) and formats matching the relevant criteria were defined as required by e-learning. When developing visual curriculum contents, the following new educational principles should be taken into consideration:

- Interactive techniques have become personalized and are able to integrate several functions;
- Mass mobile communication – everywhere and any time;
- Internet has become a "public utility" – Wi-Fi;
- Mass digitizing of learning subjects has become possible;
- Learning is no more the simple reception of knowledge but also a chance to participate in user development content;
- Developed forms of human-machine interaction;
- Independence in time and space;
- Widespread use of mobile devices;
- Possibilities of developing complex, media-rich "learning environments".

Interests of students related to the principles above:

- Improved and updated curricula;
- Access to competitive learning contents;
- Extension of flexible learning forms;
- Contents and curricula for independent learning.

Our research proved that measurable learning activities show time-dependent features that correlate with the use of visual communication forms used in the study programs. The relations of methods and techniques used in the curricula to enhance the interest of students and the respective development of learning activities are worth of further examination. In order to increase the volume of information transmitted, an alternative to changing the curriculum design, may be to increase the amount of visual elements, together with the utilization of the potential of networked learning. The next research phase will focus the creation of open curricula with rich visual content which has become an important trend in the development of contents and didactics. According to our hypothesis, visual learning may

[2] In the framework of the project, the development of digital curricula in English and Hungarian for 27 subjects was planned. From these, 10 curricula were related to subjects in the fields of technical sciences, natural sciences and mathematics. Altogether 10 curricula were developed in English. The relevant credits totalled 77; from these, 26 ones were foreign language credits, corresponding to 33%. The developed curricula are used by about 2000 students.

ISBN 978-615-5511-04-2

provide opportunities to use parables that are able to improve the efficiency of learning, currently mostly based on traditional verbal communication thus often hindered by time constraints and information pressure.

References

1. Benedek, A. (ed.) (2013). *Digitális Pedagógia 2.0.* BME APPI, Typotex.
2. Benedek, A. and Nyiri, K. (eds.) (2011). *Images in Language: Metaphors and Metamorphoses* (series VISUAL LEARNING, vol. 1, pp. 57–67). Frankfurt: Peter Lang.
3. Ferguson, E.S. (1994). *Engineering and the mind's eye.* MIT Press.
4. Molnár, Gy. (2012). Collaborative Technological Applications with Special Focus on ICT based, Networked and Mobile Solutions. In *WSEAS Transactions on Information Science and Application, 9(9),* (pp. 271-281).
5. Molnár, Gy. (2014). Modern ICT based teaching and learning support systems and solutions in higher education practice, In M. Turčáni, M. Drlík, J. Kapusta & P. Švec (eds.), *10th International Scientific Conference on Distance Learning in Applied Informatics,* (pp. 421-430). Nitra: Wolters Kluwer, Law & Business.
6. Nyíri, K. (2014). *Meaning and Motoricity-Essays on image and time.* Peter Lang GmbH.
7. Siemens, G. (2005). Connectivism: A learning theory for the digital age. In *International Journal of Instructional Technology and Distance Learning.* Available online at http://www.elearnspace.org/Articles/connectivism.htm

ISBN 978-615-5511-04-2