

Pedagogical evaluation of a web-based training in embryology: a study of image-text combinations

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Project collaboration

- Institutes of 3 Swiss Universities are collaborating within the SVC Embryology project:
 - ◆ University of Fribourg (Project leader):
 - Institute of Histology and General Embryology
 - Centre NTE
 - ◆ University of Bern
 - Institute of Anatomy
 - ◆ University of Lausanne
 - Institute of Cell Biology and Morphology

- The project team members are:
 - ◆ in Fribourg: Prof. M. Celio (Project Leader), Dr M. Adé-Damilano (Project Coordinator), Dr F. Schöni-Affolter, B. Brüschi, Dr G. Collaud, Dr H. Platteaux, Dr J.-F. Perret
 - ◆ in Bern: Prof. P. Bürri, Prof. O. Müller, Dr E. Strauch
 - ◆ in Lausanne: Prof. J.-P. Hornung, PD Dr S. Kasas, Dr C. Dubuis-Grieder



Project aim

- The Embryology project aims at creating and implementing:
 - ◆ an interactive 52 hour web-based course in embryology
 - ◆ for first and second year medical students
- The course consists of:
 - ◆ 10 modules of embryogenesis (for 1st year students)
 - ◆ 16 modules of organogenesis (for 2nd year students)
 - ◆ different interactive tools (quizz, animations, etc.) to support a better autonomous learning process of the students
- The course development is helped by:
 - ◆ all the team members
 - ◆ a formative evaluation process
- Why don't you have a look?
 - ◆ Please contact us to have access to our web site

Purposes of the presented study

- The study is focused on the continuous formative evaluation process applied during the WBT courseware
- A formative evaluation rather than a sommative evaluation
 - ◆ to feed the project during all its development by documenting specific points with the students inputs
 - ➔ improvement of the courseware efficiency (Dillon et al., 1998)
 - ➔ improvement of the project team efficiency (Krug, 2000)
- A specific study to define the best image-text combinations
 - ◆ images are a crucial didactical support of the learning process happening within a medical course (Clément et al., 1996)
 - ◆ more specifically, the different combinations of verbal and pictorial information are crucial
 - ➔ such a study allows the WBT project to take a real advantage of the multimedia potential

Methods of the study

- “The didactic thumb-rules which are nowadays used in multimedia design frequently result in wrong decisions which can be an obstacle rather than a support for learning” (Schnotz, 2001)
- ➔ It is thus very important to take into account and to apply recognized experimental results in instructional design
 - ◆ results from psychology
 - ◆ results from pedagogy
- A scientific literature review is done to determine the image-text combinations being the most efficient according to the learning process
- These ideas are implemented into a prototype and the students are then questioned on the perception they have of the resulting image-text combinations

Methods of Literature review (1)

- Memorisation effects of image-text combinations:
 - ◆ Dual coding theory: text information is better remembered when illustrated with pictures (Paivio, 1986)
 - ◆ Illustrations into text have 5 functions (Levin et al., 1987):
 - transformation: illustration recodes information of text
 - interpretation: illustration makes text information more concrete
 - organization
 - representation
 - decoration: illustration has no semantic relation with text
 - ◆ Memorisation effects of illustration regarding its function:
 - most positive effect: transformation or interpretation
 - less positive effect: decoration



Methods of Literature review (2)

- Comprehension effects of image-text combinations:
 - ◆ 1 text-image combination implies construction of 2 mental models (Mayer, 1997):
 - they help each other as long as their confrontation is positive
 - they should be presented contiguously
 - they must be coherent with each other
 - ◆ A difference between learners (Schnotz, 2001):
 - Learners with low prior knowledge profit more of image in text
 - Learners with high prior knowledge profit less (possibility of cognitive conflicts)
 - ◆ Image number has to be limited (Ainsworth, 1999)
 - the cognitive cost that images imply must remain lower than the support they bring for comprehension

Results of Literature review

- The literature review gives clear indications about:
 - ◆ what functions illustrations should play into the courseware
 - ◆ how to combine illustrations with texts
- ➔ Images and texts must be combined!
 - ◆ to make verbal and visual representations contiguous
 - ◆ courseware web pages must make this combination natural
- ➔ Images must enhance two specific functions
 - ◆ transformation & interpretation
- ➔ Images must avoid conflicts due to prior knowledge
- ➔ Image total number must be limited
 - ◆ Images are mostly used for notions that are part of the course learning objectives (a priori unknown concepts)

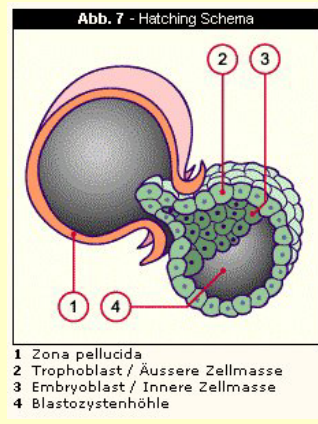
Courseware image types

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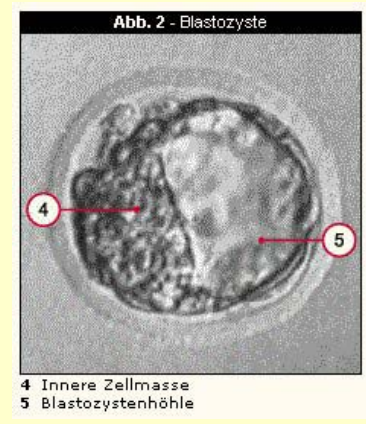
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Drawings



Photos



Interactive
schematics

Carnegie 1-23 - Netscape

Stade de Carnegie ▶	17	18	19				
Nombre de jours ▶ noir: jours avérés gris: jours incertains	41	42	43	44	45	46	47
Grandeur en mm ▶	11 - 14 ■■	13 - 17 ■■	16 - 18 ■■				
Description ▶	ipsum dolor sit amet, consectetur scing elit, sed diam nonummy nibh od tincidunt ut laoreet dolore magna aliquam erat volutpat.	Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat.	Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat.				

and Videos... (appearing in a pop up window)



Image-text combination

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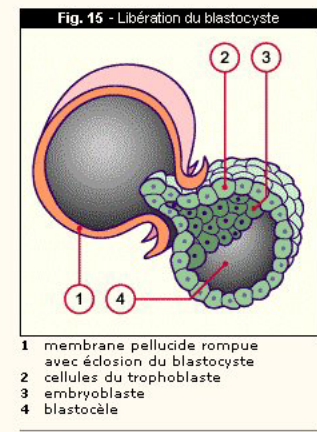
- Typical combination of image and text
 - ◆ image right of text
 - ◆ image below text
 - ➔ visual regularity
 - ➔ no ambiguity

- Other tricks to help a natural combination
 - ◆ no long text
 - ◆ a legend
 - ◆ repetition of key words

- ➔ Both visual & semantic design tricks to build a natural combination

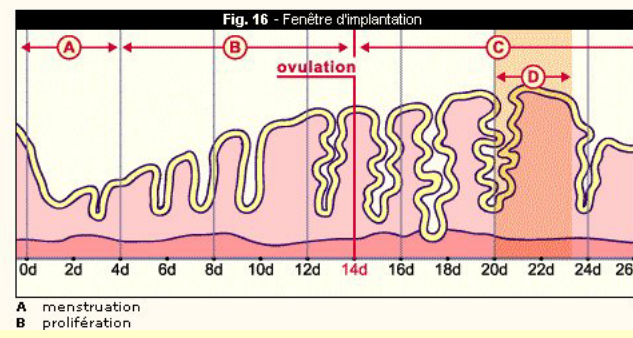
Apposition du blastocyste à la muqueuses utérine

Lorsque le blastocyste se libère de sa membrane pellucide (stade 3 de Carnegie) au 5e jour, il entre en contact avec le muqueuse utérine maternelle, en s'orientant face à l'endomètre du côté de son «pôle embryonnaire».



Légende
Fig. 15
Le blastocyste se libère de sa membrane pellucide en partie lysée. On distingue le trophoblaste constituant la masse cellulaire externe, ainsi que les cellules de l'embryoblaste (masse cellulaire interne) et la cavité du blastocyste.

Toutefois la fixation ne peut avoir lieu que si l'utérus est entré dans sa phase sécrétoire (lutéinique). Cette phase de réceptivité de l'endomètre est courte (quelques heures), elle est communément appelée « fenêtre d'implantation ». Elle correspond à la période suivant d'environ 6 jours le pic LH, au cours de laquelle apparaissent des microprotusions au pôle apical cellules épithéliales de l'endomètre. Un des rôles fonctionnels de ces protusions serait notamment l'absorption du fluide utérin, rapprochant le blastocyste de l'endomètre et l'immobilisant. A ce stade le blastocyste peut encore être éliminé par lavage. Il existe également une hypothèse stipulant que la progestérone et les oestrogènes produits par le blastocyste seraient responsables d'un oedème colmatant la cavité utérine déjà aplatie. Ce qui contribuerait également à pousser mécaniquement le blastocyste contre l'épithélium utérin.



Légende
Fig. 16
Cycle menstruel avec modifications cycliques de l'endomètre. La fenêtre d'implantation, correspondant à la période de réceptivité maximale, est représentée ici.

Methods of Student's analysis

- The analysis done with the students measures
 - ◆ the perception they have of the image-text combinations
 - ◆ not what they know about cognitive process principles
- A first course session is given in Fribourg
 - ◆ 07.01.2002 to 06.02.2002
 - ◆ about 130 students (1st Year; DE & F mother tongues)
 - ◆ hybrid course: face to face and on-line sessions
- Students fill a questionnaire at the end of the session
 - ◆ no question like “Do you memorize textual information better when it is combined with images?”
 - ◆ question like “Did you have difficulties to know what image completes what text?” or “How images are completing texts?”
 - ◆ measuring possible conflicts with a list of 30 notions:
 - 10 notions: not part of course objectives; no image associated
 - 10 notions: part of course objectives; one image associated

Results of Student's analysis (1)

- Number of questionnaires (for about 130 students):
 - ◆ 98 students volunteered / 53 students gave it back
- Associating the right image with the right text?
 - ◆ no difficulty for 83% of the students
 - ◆ 93% (of the 83%) use the unambiguous legend to do so
 - ◆ Visual regularity also recognized (but really less used)
 - image below text: 65.7%
 - image right of text: 61.4%
- Perception of image functions
 - ◆ transformation (41.5%) & interpretation (39.6%)
 - ◆ organisation (35.8%)
 - ◆ representation (20.8%) & decoration (7.5%)
 - ➔ transformation & interpretation seen as being main functions:
 - 2 sentences used to define them chosen by 71.7% and 86.8%
 - highest similar score is 54.7% for organisation function

Results of Student's analysis (2)

- What about the image number?
 - ◆ 94.4% of the students say the ratio image/text is good
 - What work quantity due to the images for achieving the course objectives?
 - ◆ the image % to be memorized / the work to do so
 - about 25% : 2.0% / normal work : 31.4%
 - about 50% : 33.0% / big work : 45.0%
 - about 75% : 39.0% / very big work : 17.6%
 - ◆ the image % to be understood / the work to do so
 - about 50% : 16.0% / normal work : 54.0%
 - about 75% : 42.0% / big work : 30.0%
 - about 100% : 34.0% / very big work : 14.0%
- Global satisfaction for the image total number which is not considered as implying a too big work quantity



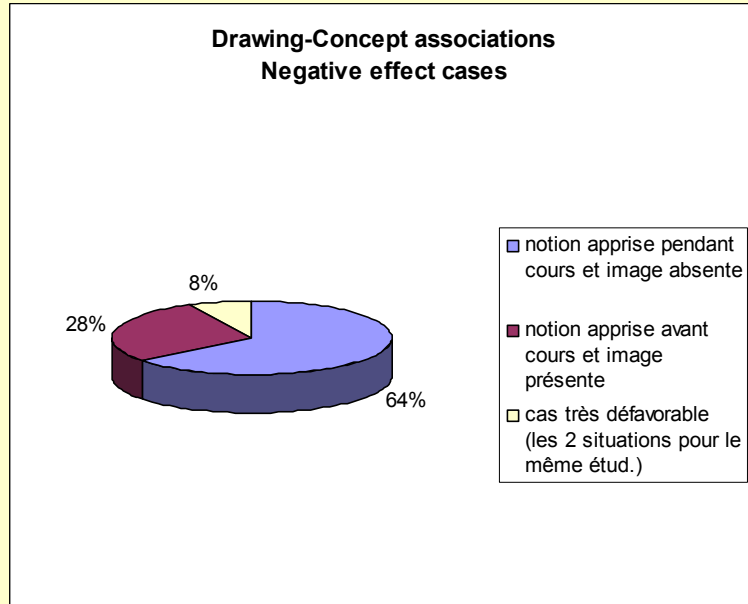
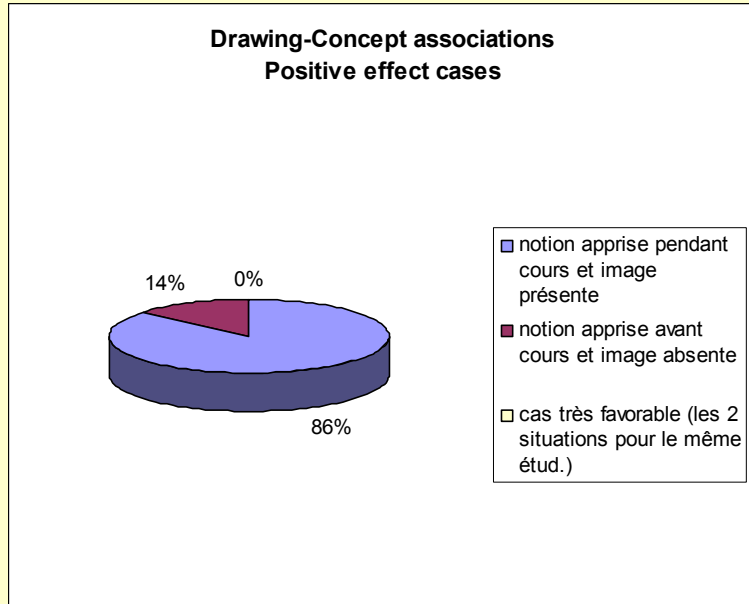
Results of Student's analysis (3)

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- Possible conflicts due to prior knowledge?



- ◆ 7 of 10 concepts with no image: learned during by 75.7%
- ◆ 4 of 10 concepts with image: learned before by 56.6%

➔ Possible missing images & negatively interfering other ones



Conclusions of analysis

- Methodological point of view:
 - ◆ a formative evaluation process is very fruitful for the learning efficiency of the courseware
 - ◆ a formative evaluation process allows
 - identification of problems
 - test and implementation of solutions
- Literature study:
 - ◆ gives clear indications, coming from already proven results, of the principles to be applied to combine texts and images
- Questionnaire analysis:
 - ◆ contiguity principle well applied into courseware prototype
 - ◆ image functions should help memorization & comprehension
 - ◆ image number seems to be adequate
 - ◆ choice of concepts to be associated with images should be further investigated

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