Enhancing traditional means of learning with emerging technologies to meet Digital Native students' expectations

Anne-Dominique Salamin
David Russo
Christophe Hadorn

Enhanced Student Laboratory
University of Applied Sciences Western Switzerland
Switzerland
adominique.salamin@hes-so.ch
www.enslab.ch

Abstract: This paper aims at reporting on the findings of two quantitative studies and one qualitative study conducted among HES-SO undergraduate and graduate students. We have outlined the characteristics of the "digital natives" generation of students attending our courses and have submitted a sample of these students to an experiment using the Google Glass, in order to assess whether the use of this new device could meet the students' expectations for accessing enriched learning resources. This paper also presents some thoughts for consideration regarding future research to be lead in the field of innovative technologies and learning processes.

"In the 21st century, technology is the key to thinking about and knowing about the world."
Marc Prensky [12]

Introduction

Constantly surrounded by ubiquitous technologies (smartphones, tablets), used to handling on-line social media to interact, the students we teach today, present similarities which differ from previous profiles: family and society educational methods, based on dialog, integration in a more horizontal society, immediate access to a plethora of knowledge available on the Internet through mobile devices, current society's requirements (people capable of taking decisions, thinking ahead, ranking and cross-checking data), constant daily exposure to massive amounts of information such as images and videos, are all elements which have contributed to shaping up a new student. Whether we use the term Student 2.0, the Now Generation, Generation Y, the famous "theorized digital natives" so-called by Prenzki, every professor will immediately pinpoint the idiosyncrasies. For such students, the act of thinking has become more important than knowledge itself, beliefs take the upper-hand on facts, the attention span has decreased dramatically, collaboration during the learning process reaches out world-wide, authority has no genuine hold on them [11].

These characteristics are commonly attributed to the new generation of students [6, 11]:

- ✓ Use technology as a natural part of their lives,
- ✓ Hedonist,
- ✓ Live in present,
- ✓ Need various activities,
- ✓ Short attention span,
- ✓ Preponderance of visual devices (video, picture, etc.),
- ✓ Zapper, gamer,
- ✓ Cooperation in work,

- ✓ Communication and peer exchanges are a central part of their lives,
- ✓ Pragmatic,
- ✓ Need to find meaning and pleasure in work,
- ✓ Need to be valorized by constructive feedback,
- ✓ Co-expert and content producer.

This portrait will become gradually more accurate and concrete as soon as coming generation grow up and enroll in higher education cursus. The idea is not to design a new education concept only by this approach. We try to match students' expectations and, with what technology applied in a pedagogical context can realize, to sustain efficient learning. Through this article we wish to present three studies performed among students attending our university, and an application based on the Google Glass aiming at enriching the students' textbooks.

The Study

More than 19,000 students enroll every year in the different curricula proposed by the University of Applied Sciences Western Switzerland (HES-SO). This university offers students strong links with the real professional environment, either via very concrete courses (laboratory work, experiments, etc.) or by helping with developing projects mandated by professionals in action, and it also offers six different domains for training: Engineering, Economics and Services, Health Care, Social Work, Music and Arts. Globally, courses are provided by lecturers in frontal learning situations, but this University enriches its pedagogical concept by including blended learning to the curriculum. So far, more than 5,000 courses have been provided on line for more than 17,000 users, published through its Moodle platform (http://cyberlearn.hes-so.ch). Most professors deliver knowledge using either online documentation or paper textbooks.
To sustain the expansion of e-learning in the HES-SO, the e-learning Centre Cyberlearn was created in 2004. Today, this Centre offers various services, ranging from LMS Moodle administration to specific resource development or online course certification. Moreover, Enslab (enhanced student laboratory) is currently cooperating with the e-learning centre (data), but orienting its approach on demonstrating by which means innovative technologies converge with this new public of students.

In an orderly approach, we firstly conducted a quantitative study in May 2013, aiming at outlining a profile for students attending a cursus at the HES-SO. Our goal was to concretely behold whether theories dealing with Digital Natives, empirical observations reported by professors in numerous universities, and the actual situation in the field, would converge. Secondly, we defined how students make use of the learning resources provided on-line. Next, we used a wearable technology (Google Glass) to develop a prototype enabling students to enhance their traditional learning process by resorting to this new type of device (GET). Finally, we selected a sample of students to conduct a qualitative study, in order to determine in what ways they learn by using such a technology.

First we will briefly present the two quantitative studies, followed by the GET prototype, before presenting the conclusions of the qualitative study, conducted among a sample of students having tested the prototype. We will discuss the results of this study and subsequently hint at the possible trends for future research.

- ✓ **Part 1 : Quantitative study : Draw a profile for Digital Native students at the HES-SO (May 2013)**

Composed of 30 questions, 20 closed and 10 open ones, the survey was submitted to students via the Moodle HES-SO home page, during 2 weeks in early May 2013. We calculated the representative sample as follows: P (percentage): 50%, M (population size): 17,430, C (confidence level): 95%. E (margin of error): 5%. Depending on the settings chosen, size of the representative sample is 376.

800 students replied to the survey. The question items aimed at discovering their habits in using the Internet, social media or mobile technologies. This survey also investigated about how they assessed the teaching methods applied by their professors. Lastly, part of the survey aimed at collecting suggestions on how to improve these methods by integrating (or not) new technologies. Students are generally learning at a bachelor

level (84%), a lower percentage of them are enrolled in master studies (12%) (4%: else). They are mostly between 18-26 years old (83%), (26-35 years old: 14%, older: 3%). 51% of them are women, 49%, men.

A number of relevant information could be observed[1] [2]. Students' habits outside the classroom affect the ways they behave in class. 85% of them access the Internet during the course against 15% who do not. Several reasons can explain this attitude: 46% access the Internet because their professor uses the Internet during the course, 29 % check on data presented by the professor, 49% seek data to supplement data provided by the professor, 68% read their e-mails, 47% browse the Internet without relevancy for the on-going course, 32% admit being bored by the course and 28 % like doing several things at the same time.

If students surf on the Internet during lectures, they also massively use smartphones in addition to their laptops: 75 % use their smartphone during lectures, 29 % frequently, 46 % sometimes. The survey seems to show that students do not necessarily wish to merge private technologies habits with those of the classroom: only 31% wished to get their hands on pedagogical mobile applications, even though more than 75% use a smartphone in class; if they admit accessing the internet for playing games, among other activities (55%), only 29% actually wish to be provided with a serious game resource during class.

Visual preponderance

Many students suggest using video as a training support. Some appreciate the use of films watched in class for spurring discussion, others propose to work on the theoretical parts and deliver them in the form of videos. Yet others prefer to have the course video-pod-casted to enable revisions before exams. (« *I would like a course consisting partly in lectures, partly in group work and partly in video, image, audio files* » , « *Videos and visual aids are important*. », « *the theoretical part taught by the professor, followed by exercises or tasks delivered in various formats (dramatization, video, writing*. »).

The request for using a video hits the top score: 55% wish to watch more videos and 40% would like video-podcasted courses. (several answers possible)

Some of these answers can be linked to students' learning profiles. 69 % say they learn better with video, pictures or graphs, 51 % by performing practical experiments and 39 % learn by conducting laboratory experiments or playing with simulations.

Inborn use of technology

The propositions emanating from students are very clearly stated, all of them wish to see more technological resources be developed : 31% would like more mobile applications and 30% serious games. (several answers possible). In spite of these claims, a clear 49.4% prefer not to use their smartphone in class to vote, to search and share information, to answer quizzes, against a 36.4% wishing to do so, while a 14.3% selected the option "don't know". Finding themselves in a class situation, where professors and other students are "available" might have influenced the result. Besides, in many school departments where students tend to use their private laptop for studying, the smartphone becomes a more "intimate"[3] tool to keep in touch instantly (via applications such as whatsapp, telegram, etc.) with the communities they belong to (friends, sport, culture, etc.).

About 70% of the students' propositions appear to be linked to the use of technology, ranging from a whiteboard connected to the internet and automatic broadcasting of data into the Moodle environment, to podcasted or live broadcasted courses, not forgetting the use of videoconferencing to follow-up on courses, as

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[1] for more detailed information, see : http://www.editlib.org/noaccess/115119/

[2] bare data translated in English is available on demand by email.

[3] We are currently conducting a wide comprehensive study using video to retrieve students' witness statements on how they consider their smartphone. 100% out of 15 students say « it's like one of my hand ». Results will be available in 2 years.

well as ready-made resources available on computer tablets. Some students highlight how some professors lack the mastering of new technologies compared to them. (« *A course where tablets and smartphones would not be badly considered and where they could be regularly used. Professors and schools lack behind for more than 10 years. First professors should be trained, because some are not even capable of connecting a beamer, for instance*». A more frequent use of quizzes before the course, during the course (either at the beginning or at the end) and for use at home is requested by all students, even those who wish to maintain a maximum of class interactions.

- ✓ **Part 2 : Quantitative study : Using pedagogical resources provided on-line by professors (June 2014)**

We then wished to find out the consumption trends of the learning resources provided by the professors on-line on the Moodle platform

Therefore, we launched a quantitative survey which asked this only question: "Do you print the resources provided by professors on the Moodle HES-SO platform?".

We calculated the representative sample as follows: P (percentage): 50%, M (population size): 17,430, C (confidence level): 95%. E (margin of error): 8%. Depending on the settings chosen, the size of the representative sample is 149.

161 students replied to this question and, surprisingly, it was found that a majority of 67% actually print all documents available on-line, against a 29% who read them on-line, while 4% chose the option "Don't know". Clearly, long texts (sets of PowerPoint slides, course hand-outs, articles, essays, etc.) are still considered the best and easiest means for being carried around and manipulated (annotate, read, summarize, quote etc.).

The GET application prototype

We found the results of the first survey stunning in that we noted how accurately the students appear to identify which resources they appreciate, how they learn and what means they need. Thus, we reckon that after an average of fifteen schooling years, starting at nursery school, our students have somehow become "professional" learners, who know exactly how they learn best, and are therefore very unlikely to be willing to alter these life-long and well-polished learning habits.

On grounds of these findings, we wished to provide the students with a tool which could address four aspects concurrently:

- Maintain the provided documentation in paper format,
- Offer a wider variety of learning resources (image, sound and video which is a combination of the two previous ones),
- Use an innovative technological product,
- Address the student's request for obtaining learning resources which he knows are the most performing for his personal learning process.

Therefore, we have developed a prototype application which aims at enriching the reading of a paper hand-out, by offering complementary resources via the Google Glass (1st release). We also wished to adapt the learning resources as requested by the student: The student who indicates that he prefers to receive a video rather than a quiz, will be delivered, through the Google Glass, a video of a witness statement, a laboratory video, a complement provided by the professor rather than a multiple choice questionnaire.

GET features

1. The student fills in an on-line questionnaire to define which multimedia resources he generally prefers to enrich a paper course hand-out. His preferences, his pseudonym as well as his password are saved in a database,
2. The learner puts the Google Glass on and proceeds with authentication. The application retrieves the pseudo and the learner profile from the database for registration in the Google Glass,
3. The learner reads the textbook. In some parts of the textbook, a marker such as a QR code appears : this is the place where the learner can access multimedia resources adapted to his profile using the Google Glass,
4. The student scans the QR code via the glasses,

5. The Google Glass retrieves the identified resource from the database
6. The same step is repeated right through the textbook.

We chose a QR code type marker to access complementary information, because it can be easily captured by the Google Glass, and is relatively common in everyday life so as not to unsettle the student. We conducted several tests (text, numbers, voice request etc.) before focussing on the QR code. Moreover, to avoid showing the same resource several times, we implemented a history log system. When the user has already watched a resource, a prompt will indicate that this resource has already been consulted. Every time a resource QR code is scanned, the system checks in the returned resource list whether the student has already watched it.

Enriching the learning process

An on-line questionnaire enables the student to define his preferred adapted personal learner profile (PAP) : In this way he can select the type of resources which enrich the textbook. These resources are, thus, adapted to every student who can browse the displayed resource contents quite naturally thanks to the glasses. So, he can resume reading the textbook while watching the resource without effort and fluidly. For instance, he can watch the video and underline the passages which he finds important on the paper textbook, according to what he sees through his glasses.

Firstly, we have defined the type of resources which must appear in the glasses. We have described the various didactic components which could be potentially interesting for integration in the Google Glass.

Didactic components	Existing on paper
Theoretical explanation	Yes
Instruction	Yes
Summary	Yes
Example of real life, witness statement, simulation	No
Illustration : Image, Diagramme, Graph, Table	Yes
Interactive quiz	No
Social Interaction	No

Figure 1 : Didactic Components

We proceeded with the description of the types of technological resources:

- Video (podcast, demo, witness statement, summary, practice, etc.)
- Audio (podcast, witness statement, summary, etc.)
- Image (plan, diagramme, slide show, animation. etc.)
- Quiz
- External web page (Interactive content)

By crossing the type of technological resources proposed with the resources unavailable on paper, the following resources are proposed in the questionnaire needed to define the preferred student profile:

- Interactive animations,
- Summaries (video /audio),
- Additional explanations (video / audio),
- Advice (video / audio),
- Video illustrations (Example of real life, laboratory, detailed solutions),
- Video of witness statements,
- Interactive quizzes,
- Animated illustrations.

At this step, the student having mentioned his preferences in the PAP, will be provided with the complementary multimedia resources adapted to his profile, via the Google Glass.

✓ **Part 3 : Qualitative study : Using Google Glass Enhanced Textbook (GET) (August 2014)**

For this third study, we wanted to apply a qualitative approach for two main reasons. On the one hand, only one pair of Google Glass was available, and since this device is, as yet, not on sale in the European market, no student could test the glasses at home. A quantitative survey was, therefore, impossible to set up.

On the other hand, we were more concerned with understanding the behaviour of users confronted with the Google Glass and the enriched textbooks, rather than quantifying the results. We focussed on interpreting their motivation, their impressions, the ease of learning with glasses, their feelings, opinions and impressions concerning this project.

For this study, we recruited nine students, four men (44%) and five women (56%), corresponding to the typical HES-SO student profile. This sample also represents the occurrence of students corresponding to the fields of studies of the first two surveys, thus Economics and Services, Engineering and Architecture, Social Work and Health. This group age averages 24,75 years, which ranges above the upper limit of the Digital Natives population.

Protocol

The interviews took place individually and lasted 1 hour. After a brief explanation of the project and the objectives of the interview, 30 minutes were needed to master control of the glasses and the application. The questions concerning the impression and assessment of the project lasted 30 minutes. They included questions on the Google Glass itself, the QR code scanning, the available resources and the overall interest in the system as a learning tool.

Results of the study

1. Questionnaire on the preferred profile - summary :

PAP (Adaptation of resource to preferred profile)	Number	Frequency
Useful questionnaire	8	80%
Sufficiently detailed questionnaire	8	80%
The questionnaire lacks real examples	3	30%
The questionnaire contains too many didactic resources	1	10%
Would prefer to complete the questionnaire in the glasses	1	10%

Table 2 : PAP evaluation

2. The system - summary:

System	Number	Frequency
The glasses present at least one default	**9**	**0.9**
The displayed screen is difficult to see	9	90%
Scanning QR codes is time consuming	5	50%
Watching the resources is time consuming	5	50%
The system is not convincing for improving learning	8	80%
The system hinders concentration	5	50%
The glasses contribute no more than a PC or a tablet	3	30%

System	Number	Frequency
The system impedes remembering and memorizing of a written text	1	10%
The system is a pleasant means for learning	4	40%
Feel that they have progressed in their learning using this system	9	90%
Would purchase the system once on offer	4	40%
The system proves to have great potential for the learning process	5	50%
Accessing multimedia content via the glasses is positive	9	90%

Table 3 : System evaluation

3. The proposed resources – Summary:

Resources	Number	Frequency
Prefer video and quiz resources compared to sound and images	9	90%
Consider the complementary resources as enriching	9	90%
Appreciate that the resources are adaptable to their request	9	90%
Find that the provided resources correspond to their first choice	9	90%
Appreciate watching a resource even if it was not part of their first choice	9	90%
Estimate that the video and quiz resources have facilitated their learning process for the given topic	8	80%
Appreciate the multimedia resource contents	8	80%
Estimate the length of video resources should last between 1 to 3 minutes	8	80%
Estimate the length of video resources should last more than 3 minutes	8	80%
Do not appreciate audio resources	7	70%
Estimate the manipulation time needed to access the quiz and web site type of resources is too long	4	40%
Appreciate the interactivity provided by the glasses	5	50%
Estimate that the resources ought to be available on paper format	1	10%

Figure 4 : Resource evaluation

The students point out the advantages and drawbacks of the prototype application.

Advantages :

- Being able to use a new technology for studying,
- Being able to access a wide variety of learning resources (text, video, sound, quiz, etc.),
- Having a direct connection between what is read and the multimedia resources displayed in the glasses,
- Having their hands free for taking notes,
- Being able to read the paragraph again while watching the multimedia content,

- Receiving personalized resources corresponding to their wishes,
- Accessing a system easier to handle than a computer or a tablet

Drawbacks :

- Increased time spent for studying,
- Difficulty in watching some resources (dimness of the test room),
- Default with the current Google Glass :
    * difficulty in seeing the screen,
    * eye strain after a few minutes of use
    * overheating of the glasses,
        - discomfort for optic glass users,
        - the QR codes are too big,
        - loss of concentration when navigating between text and glasses,
        - the text becomes less interesting compared to the multimedia resources.

Enhancements proposed by the students :

- Fewer QR codes,
- More resources for each QR code,
- Place all QR codes at the end of the course hand-out and place references in the text to point to the QR code to be scanned,
- Provide a utility for searching resources via the glasses,
- Gradually build the student profile while the course hand-out is read and the multimedia resources watched via the glasses,
- Remove the slide shows in the glasses and place them directly on the paper hand-out.

Findings

While assessing the proposed system, we have observed that, even though the students' requests were not totally met, mainly due to the weakness of the Google Glass used here, the adaptation of resources according to the desires formulated by each student (and not the adaptation to a supposed student profile, for instance aural, visual, kinesthetic etc.) had a resounding success (Survey Part 3: 9 out of 10). We draw a connection between this result and how ready the students are, via the social media for example when choosing, deciding, expressing themselves, and acting according to their own expectations, for monitoring their own learning process. Indeed, this is a specific characteristic of Digital Natives: deciding actively on the means for learning and appreciating creativity and involvement in short and thrilling activities [6].
The students' answers equally show a strong attractiveness for interactivity and multimedia (video and quiz) (Survey Part 3 : 9 and 8 out of 10). It seems to us that the interest for such devices at university level is a result of the habits of civil society regarding daily consumption of non textual resources.
Globally, in 2013, 90% of world-wide users watch video content on the Internet from any type of screen. More than a billion different users check Youtube every month and watch more than six billion video hours, without mentioning that a 100 hours of video are uploaded every minute on this very site [5]. Nine out of ten 18-to-29-year-olds watch online videos, and almost half, 48%, watch online news videos [5]. In Switzerland, in 2010, all age groups considered, 44% were found to watch video clips on the Internet [4], while in France, the 13-24 age group, 34% ,acted similarly. The contents range from advertisements, personal videos, film trailers, extracts of TV programs, on-line investigations (webdocs). 1% of the 76% students in our survey watch Youtube videos during class. [14]

Additionally, as mentioned by Zur, students « Prefer receiving information quickly and simultaneously from multiple multimedia and other sources » [6]. In this aspect, the developed system meets the expectations.

In attempting to overlap an innovative technology (glasses) with an older « technology » (book), we managed to get the students involved and have observed that they enjoyed interacting with the system. This may

be due to the Google Glass reputation, before becoming available for the general public, and may thus, have spurred the interest for this device.

Moreover, our drastic approach aiming at offering resources to a student-subject (according to what he wishes to receive) as opposed to a student-object (according to what psychological and pedagogical studies claim) confirms what the studies have demonstrated: the student values the importance of choosing resources according to his own idea of how to best sustain his learning process. (Survey Part 3: 9 students) and appreciates it when the system actually delivers the requested resources (Survey Part 3: 9 students).

As to the use of sophisticated technologies for studying, it is relevant to notice that what the sample group feels uncertain about concerns less the actual use of an innovative device, but rather the group doubted about the use of the "prototypal" device which presented defaults, inherent to this type of technology (heat, vision accuracy, convenience for people wearing glasses etc.)

Possible hints for future research

At this stage, we want to consider several possible directions for future development :

1. **Video**
   Although this media is widely appreciated by students, we nevertheless wish, for this particular situation where video was provided with illustrations of didactic components, to determine which actual components directly favour the learning process (attention, remembering, memorization, retrieval), what might be their impact on motivation, and finally what (or what combination of factors) sustains the transfer of the learning processes towards real professional situations.
2. **Wearable technologies**
   Ranging from bracelets, glasses and connected watches, we want to develop and measure the impact of means used for increasing students' awareness concerning their learning modes and strategies.
3. **Increased reality**
   Finally, we wish to investigate the interest in increased reality coupled with video in order to determine if the use of these technologies impact the learning, the retrieval and the transfer of elaborated knowledge processes.

As Prensky claims : « Our students have changed dramatically. Our educational system is devised for teaching people who no longer correspond to these students » [11]. Merging innovative technologies with traditional learning resources represents a step in addressing this issue. We believe that technology must not prevail over the pedagogical intention, but must result from it. The main aim of using such innovative technologies in the educational context consists in favouring the emergence of flexible pedagogies [18]. It must also contribute towards facilitating, widening and enriching interaction between students and knowledge, in order to sustain the learning anchoring and transferability. Lastly, the complex world, the chaotic and unsettling situations which our future university graduates will face, implies that they need to have been confronted to new means for coping with knowledge, both more flexible and more solid, in order to favour the emergence of an efficient and scalable "know-take action" approach in a professional context.

References

Web

[1] THE CHRONICLE, *For Many Students, Print Is Still King*, [en ligne], http://chronicle.com/article/For-Many-Students-Print-Is/136829/ (consulté le 26.05.2014)

[2 Baier, K., Hendricks, C., Warren Gorden, K., Hendricks, J.E., & Cochran, L. (2011). *College students' textbook reading, or not!* American Reading Forum Annual. Yearbook [Online], Vol. 31

[3] http://www.bfs.admin.ch/bfs/portal/fr/index/themen/16/03/key/ind16.indicator.30106.160204.html

[4] http://www.youtube.com/yt/press/fr/statistics.html

[5] http://www.journalism.org/2014/03/26/news-video-on-the-web/
[6] Zur, O. & Zur, A. (2011): On Digital Immigrants and Digital Natives: How the Digital Divide Affects Families, Educational Institutions, and the Workplace. Zur Institute - Online Publication. Retrieved on month/day/year from http://www.zurinstitute.com/digital_divide.html.
[7] LIBRARY UNIVERSITY OF MICHIGAN, *Demographic Data on Textbooks and Usage Statistics: Implications for Textbook Cost-saving Analysis*, [en ligne], http://www.lib.umich.edu/files/Cost-Analysis-Student-Survey.pdf (consulté le 30.05.2014)
[8] National association of college stores, *FAQ on College Textbooks*, [en ligne], http://www.ecu.edu/cs-admin/studentstores/Textbooks/upload/Textbook_FAQ.pdf (consulté le 24.06.2014)

Bibliography

[9] Anglin, G. J. (1995). I*nstructional technology : past, present, and future (2nd ed.)* . (C. L. in Englewood, Éd.)
[10] Dolto, F. (1979). *S'ennuyer à l'école est un signe d'intelligence,* Le Monde de l'éducation, n° 49, avril.
[11] Prensky, M. (2001). *Digital Natives, Digital Immigrants 1 et 2.* (Vol. Vol. 9). MCB University Press.
[12] Prensky, M. (2013). *Our brain extended*. Technology-Rich Learning, volume 70, Number 6, 22-27
Silver, Lawrence S., Robert E. Stevens, and Kenneth E. Clow (2012). *Marketing professors' perspectives on the cost of college textbooks: a pilot study*. Journal of Education for Business. 87#1 pp: 1-6.
[13] Stone, Robert W., and Lori J. Baker-Eveleth (2013). *Students' intentions to purchase electronic textbooks.* Journal of Computing in Higher Education 25#1 pp: 27-47.
[14] Salamin, A. D. (2014) *Using Google Glass to enrich printed textbooks in a blended learning environment to fulfill digital natives expectations*. AACE, p. 9
[15] Wertsch, J. (1990). *The voice of rationality in a sociocultural approach to mind*. In L.C. Moll (Ed.) Vygotsky and Education : Instructional implications and applications of sociohistorical psychology (pp.111-126). Cambridge, MA: Cambridge University.
[16] Yonker, E. & Cummins-Sebree, S. (2009). *To read or not to read: How student characteristics relate to textbook reading*. AURCO Journal, 15, 163-172.
[17] Hadorn, C. (2014). *Google Glass Enhanced Textbook (GET*), Master Thesis under supervision of Prof. Anne-Dominique Salamin, MSc HES-SO en Business Administration.
[18] Gordon, N. (2014) *Flexible pedagogies : technology-enhanced learning*. The Higher Education Academy.
[19] Le Boterf, G. (1994) *De la compétence, Essai sur un attracteur étrange*. Paris, Les Editions d'organisation.