Universitat Autònoma de Barcelona

TREBALL DE FI DE GRAU

The perception of students from different university disciplines of the use of PowerPoint by teachers

(Contreras, B.)

Departament de Psicologia Bàsica, Evolutiva i Educació

Grau de Psicologia

Tipus de TFG: Recerca

Data: 15/05/2015

EXECUTIVE SUMMARY

KEY STAKEHOLDERS

The principal stakeholders to whom this project is addressed are Educational Psychologists and Pedagogues of Higher Education. More specifically, the recipients of this research should be the Department of Basic, Developmental and Educative Psychology, the formation and teaching innovation unit and finally, the Department of Applied Pedagogy. Being all of these previous departments from Autonomous University of Barcelona (UAB).

Nowadays, the presence of ICT (*information and communications technology*) in class has generated a change in pedagogical practices and in the understanding of how has the learning process be. The Education System is leaving behind it the teacher-centred approach in favour of a student-centred one. This fact implies a change in the role of the teacher, who is not just a transmitter of knowledge but a guide of the students learning process. Then, PowerPoint has the function of supportive tool for this new role.

As all the tool we use in our daily routine, teachers should be aware of the PowerPoint features, advantages, drawbacks and how is the efficient way to design and to use it within Educational context. To reach this, they also should take a specific course or formation lead by stakeholders previously mentioned.

CURRENT COGNITIVE IMPLICATIONS OF POWERPOINT

The pedagogical debate about the effectiveness of PowerPoint on the improvement of the learning outcomes is still alive. While its use has been widespread among a variety of different fields and public situations that require social interaction to transmit information or knowledge, PowerPoint seems not to be appreciated in the same way by teachers of Higher Education. After the novelty effect in their first years of usage inside classrooms, the PowerPoint tool is often blamed for decreasing students' attendance and their interactions with teachers. Furthermore, it is accused of promoting a passive attitude in students towards their learning process. As a consequence, teachers reported the critical thinking and the meaningful learning diminish too. The reasons could be related to the content and features of PowerPoint with the information coding and if the instructor provide the slides before the class.

Information System

Paivio in 1986 with his dual coding theory established that two independent although interconnected systems- visual and verbal system- participate in the information processing. This interrelationship let that information of PowerPoint has a double representation in our memory and when students are asked for recalling the content in their exams, they can retrieve it by two ways - visual and verbal-. It means there is a higher probability to remember the information teacher wants the students learn.

Content and feature

It also has to be taken into account that the presence of *computer-generated slides* add more information to process (the visual content on the slides) by students demanding more cognitive resources to that goal. If the features of PowerPoint or its content evoke high levels of arousal, the processing system can be overwhelmed. Why? Because the cognitive load- the amount of mental effort used by working memory to process the information- is higher than what working memory can make.

Instructor-Provide Slides

Another factor, involved in the learning outcomes is the type of uploading of slides in Moodle before the lectures. If they are full notes of the course, students may adopt a passive attitude or even don't attend to the class, whereas in partial notes case, the attendance is necessary, the accumulation of notes is higher and with a good note-taking skill the learning outcomes may be better.

SOUGHT AIMS

On the other hand, students has their own perception about this issue and to know it has been essential to achieve our main goal: discover what is the real use of PowerPoint by teachers among university disciplines - Social Sciences, Education, Engineering, Pure and Health Sciences- and in the lowest level course of a degree in comparison with the uppermost one. In addition, the type of PowerPoint design is predominant in the previous variables.

SAMPLE AND DATA ANALYSIS

The quantitative and qualitative information obtained proceed from a sample of 400 students of several disciplines from UAB, and 200 student of a High School, with a questionnaire from (Roheling,P.V. & Trent-Brown, S.,2011)* which has been translated into Catalan language and adapted to the level of comprehension expected in each institution. Statistical analysis with SPSS v.20 programme has been done.

*Roehling, P.,& Trent, S. (2011). Differential use and benefits of PowerPoint in upper level versus lower level courses. *Technology, Pedagogy and Education, 20*(1), 113-124.

RESULTS

Nearly 90% of students reported their teachers use the PowerPoint in lectures being almost 100% of university instructors who use it daily above all whom teach in Pure Sciences. In addition, PowerPoint is more displayed in the uppermost level course. The variables that are affected by the computer-generated slides in a positive manner are the understanding of key concepts and the content in general while in a negative way the critical thinking and the note-taking. Besides this, it remains without clear conclusions, provided that it's not statistical significance, how PowerPoint affects the feeling of learning, participation and the attendance.

To sum up, during the lecture the presence of PowerPoint supports the talk of the teacher when Presentations have predominantly graphic-schematic content (which also includes drawings as a part of it), that according to the theories of Paivio and Sweller, is the ideal design to obtain better learning outcomes.

IMPLICATIONS FOR STAKEHOLDERS OR RESEARCHERS

The results found show the need of establishing guidelines for instructors which should include how the techno-pedagogical design has to be, taking in consideration the discipline in which the subject belong to and the level where it is given.

Assessment courses should be done each year too, with the updating findings from research. Moreover, students have to know which the aim of the use of PowerPoint is and how they can take the maximum profit from slides in order to improve their learning outcomes.

PRESS RELEASE

The students have talked:

The use of PowerPoint affects their learning process

This project examines what is the real use of PowerPoint by teachers from different disciplines of UAB through the perception of their students. The results show that there is a generalized and daily presence of PowerPoint inside the classrooms, predominantly in the uppermost level course. In this research is demonstrated PowerPoint helps students to understand the content and key concepts of lectures as well as is the graphic-schematic PowerPoint design which mainly supports the talk of teachers.

Reference:
Coll, C., Rochera, M., Colomina, R. (2010). Usos situados de las TIC y mediación de la actividad conjunta en una secuencia instruccional de educación primaria. *Electronic Journal of Research in Educational Psychology,* 8*(2),* 517-540.

Effectiveness of PowerPoint tool in the improvement of learning variables

Powerpoint is a software tool daily displayed in multiple context with different purposes. According to Coll, Rochera, Colomina (2010), presentations play an important role in teaching-learning activities, where students and teachers participate all together. Even so, not only can presentations be related to the interventions of the instructors but also with the listener or reader.

During the second semester of the academic year 2014-2015, 400 students of UAB- of Social Sciences, Education, Engineering, Pure and Health Sciences- and 200 students from the High School IE Costa LLobera were asked for filling out a questionnaire about their perception of the usage of PowerPoint by their teachers. These questions contemplate variables as the type of PowerPoint design and how it affected to the following learning ones: the critical thinking, keeping the attention, attendance, note-taking, understanding the content and feeling of learning.

Having into account this learning aspects, the project had as a goal to contribute to clarify what is still in the focus of pedagogical debates: how the PowerPoint affects the learning process of students.

The results show that during the lecture, the presence of PowerPoint supports the talk of the teacher above all when Presentations have predominantly schematic content. So, this content need to be explained by the teacher to be understood while at the same this content helps to reduce the cognitive load in students working memory. Then, Presentations with PowerPoint software often help students to understand easier the meaning of key concepts and their interrelationships which are framed inside different theoretical frameworks.

Students note-taking decreases with the display of computer-generated slides but this doesn't imply a drop in its quality. It may be diminish because:

- *Have printed the slides facilitates a fast elaboration of the information.*
- *Students just take notes about what is more relevant or difficult to understand.*

In addition, they don't boost critical thinking in the thought of students. Behind critical thinking, there's a teacher who inspires his/her students with their knowledge, with the way he/she transmits his/her feelings about it in verbal and nonverbal communication processes and also the effective use he/she does of ICT and other tools always with pedagogical aims in mind.

It can't be assured PowerPoint has a positive neither a negative effect on the following variables: attendance, interference of students thought, the attention to the teacher and the material as the statistical results show. Provided that individual differences of students as a learners and of the teachers as communicators define a wide range and play an important role with multiplicity of interactions.

The perception of students from different university disciplines of the use of PowerPoint by teachers
Contreras, B. (2015)

ABSTRACT

The use of PowerPoint in Higher Education is still on the focus of pedagogical debates. While teachers claim this tool decreases the interaction with the students and their learning outcomes, students perceive PowerPoint as beneficial for their learning process during the University stage. The present study has examined the real usage of PowerPoint by teachers from the perception of students, how its design varies among disciplines, between the lowest and the uppermost course of the degrees and how it affects to some great learning variables. Results show that nearly 70% of students have teachers who display always PowerPoint in his/her lectures and schematic-graphic design, the most suitable design for a better coding of the content is mainly projected in Social Sciences.

Keywords: Powerpoint, student performance, Powerpoint design, note-taking, attention, feeling of learning, class attendance

RESUMEN

El uso del PowerPoint en la Educación Superior continúa siendo uno de los principales focos en los debates pedagógicos. Mientras el profesorado afirma que esta herramienta disminuye la interacción con su alumnado, los estudiantes perciben su uso como beneficioso para su proceso de aprendizaje durante la etapa universitaria. Este estudio se ha centrado en el uso real del PowerPoint por el profesorado desde la percepción de los estudiantes, en cómo su diseño varia entre disciplinas, en el primer y último curso del los grados universitarios y como afecta a unas determinadas variables de relacionadas con el aprendizaje. Los resultados muestran que cerca del 70% de los estudiantes tienen profesores que usan siempre esta herramienta de presentación en sus clases magistrales. El diseño gráfico-esquema, el más adecuado para una mejor codificación del contenido, es el más proyectado en las Ciencias Sociales.

Palabras Clave: Powerpoint, disciplinas, actuación del estudiante, diseño de Powerpoint, toma de apuntes, atención, percepción de aprendizaje, asistencia a clase.

1.INTRODUCTION

Nowadays, the use of ICTs increases considerably inside classes. It is an unstoppable process which has generated a change in pedagogical practices and in learning since their implementation at schools, high schools and universities. Moreover, the development of traditional resources to the ones that at present we know also produce a transformation: passive learning has turned into an active learning. These changes are considered outcome variables but the organizational intervention, which affects them, remains on the main external input: the Government ICT Policy that beside school leadership and school climate makes possible the ICT implementation strategies. It is the comprehension of this last idea as the translation of policies to practices.

Constructivism approach

Thanks to ICTs, the transition from a teacher-centred approach, where the teacher acts as a transmitting person of knowledge, to a student-centred one it is a reality in this learning process which is being consolidated although in a slow way.
This last approach is framed in the Constructivism whose psychological aspect claims learning is a result of the learner's active implication in the meaning and knowledge construction. Also it has to be said that new knowledge is constructed on previous mental models. On the other hand, its social aspect regards that students learning takes place in a located social process inside joint activities with professors, around the contents and academic tasks, remarking an intermediary function of the teacher as a guide (Coll, 2010).

Muraro (2005) described three basic uses of ICT. Firstly, ICT as a learning target and therefore introduced as a subject in the school curriculum. Secondly, as an instrument of learning where its use helps to solve difficulties coming from other subjects. And the last one, as a supportive instrument for the professor.
Below, this research will be gone in depth on presentations which fulfill with the supporting use.

Instructors and the effectiveness of ICT

Notwithstanding the power of ICT in learning and pedagogical changes, we should not forget that the figure of the teacher is still there, hence the effectiveness of ICT is found in how professors use them. Badia, Meneses & Sigalés (2013) claim there are six characteristics which are influencing the facilitation of the educational use of ICT in the classrooms: the perception of usefulness, the ability to innovate, expertise, attitudes, beliefs about teaching and learning and feelings in relation to ICT. This point can be applied to PowerPoint, where having positive values in these factors might be a meaningful predictor of presentations' success.

PowerPoint

Powerpoint is a software tool daily displayed in multiple (Savoy, A., Proctor, R.W & Salvendy, G., 2009) contexts (i.e. conferences rooms, lecture halls, in business companies...) with different purposes.
According to Coll, Rochera, Colomina (2010), presentations play an important role in teaching-learning activities, where students and teachers participate all together. Their use helps to amplify determined performances of the professor like explaining, illustrating and relating the content the teacher wishes that reach to their students. Even so, not only can presentations be related to the interventions of the instructors but also with the listener or reader.
For this reason, Neville established that the main functions of PowerPoint were: as a guide for the speaker, as a guide for the listener/reader and even as a text to solely be read independent of the oral speech (Cladellas, R., Castelló, A., Badia, M., Cirera, M., 2013).
While it might be true the ideas previously presented, many arguments against PowerPoint are still taking part of pedagogical debates. It will further be discussed in the next section.

2.BACKGROUND LITERATURE

2.1 Memory and Learning

- ***Coding information***

Memory can not be avoided when learning is get involved in. There isn't just a manner to code information. As this study is focused on the lecture classes with PowerPoint, it is taken into account only two coding ways: the symbolic and the images one. *Symbolic coding* is represented by memory in words, alphanumeric code and other systems (i.e. maps, graphics…), whereas the images coding stores the physical properties of the environment (Olmos, M., Carranza, J.M, 2007, p. 288). Kosslyn in his model of mental representations identifies two types of images divided in objective images (drawings) and subjective images. These subjective or *mental images* save the properties of real objects without the need of having them physically and facilitates learning and make their memory lasts more. (Cladellas, 1996).
On the other hand, Paivio in 1986 with his dual coding theory establishes that two independent although interconnected systems - visual and verbal system- participate in the information processing (Estaún, S., 1996; Levasseur, D.G & Sawyer, K., 2006). This interrelationship lets that stimulus have a double representation in our memory and when someone is asked for recalling the information this can be retrieved verbally (i.e concepts), visually (mental images) or both at the same time (i.e. concrete concepts with a mental image associated). Therefore, when they are combined, better the learning outcomes are (Levasseur, D.G & Sawyer, K., 2006) because the content of the lecture class with computer-generated slides can be recalled by two ways. It means there is a higher probability to remember the information teacher wants the students to learn.

- ***Processing Information***

It is a known fact, expressed by Baddeley in his research, working memory has a limited capacity to process information, a limitation that influence on attention processes being limited as well. Attending to a determined number of stimulus will depend on how much quantity of cognitive processing they require (Ellis, J. 2003, p. 222).

Content and Features of Powerpoint

The presence of *computer-generated slides* add more information- the visual content of the slides- to process by students demanding more cognitive resources to that goal. If the content of PowerPoint evokes high levels of arousal, with great levels of sensory stimulation, the processing system can be overwhelmed (Levasseur, D.G & Sawyer, K., 2006). This fact could be explained as a consequence of the cognitive load- the amount of mental effort used by working memory to process the information- is higher in this situation than the effort the working memory can make (Van Bruggen, J.M., Kirschner, P.A., Jochems, W.,2002).

Then, slides would affect negatively to the auditive information provided by the instructor, being it harder to retain (Savoy, A., Proctor, R.W & Salvendy, G., 2009). Not only would the excess of arousal be the responsible for this but our better capacity to process visual information too (Levasseur, D.G & Sawyer, K., 2006). As a result of the decrease of audio processing, the interaction between teacher and his/her students would diminish too. In addition, if the instructor reads the PowerPoint the dynamic of the lecture would become monotonous (Cladellas et al, 2013) reducing the motivation of students, therefore their level attention. Nonetheless, the level of arousal got with the usage of PowerPoint may vary depending on the design of Powerpoint.

Regarding those negative aspects, the cognitive load can be reduced by the integration of the two modalities-visual and verbal- of the content in the PowerPoint. It makes the attention can be focused in just one point, avoiding the divided attention also called split-attention effect, between these two types of information (Van Bruggen, J.M., Kirschner, P.A., Jochems, W.,2002).

Some studies of Cladellas et al (2013) and other authors (Savoy, A., Proctor, R.W & Salvendy, G., 2009) pick the critics of Tufte up about Powerpoint which are its schematic nature, the simplicity of ideas it

produces, the indiscriminate use of colors, its low resolution and its power to make the verbal and spatial reasoning weak. The perception of students about the main features that a PowerPoint would have to have (Levasseur, D.G & Sawyer, K., 2006) includes color combinations with significant contrasts but not busy colors, light or quiet backgrounds, large and variable fonts. These characteristics then may help to keep the attention on the lecture.

Another focal point to mention is related to *learning styles* which understood by Dunn, since the dual coding theory, it refers to the fact that students learn more from pedagogical approaches suited to their preferences (Levasseur, D.G & Sawyer, K., 2006). Following this idea, the combination of verbal content (oral lecture and slide text) with visual elements (slide images) may be a standard solution to cover a big range of individual differences within visual learners and verbal learners.

- ***Instructor-provide slides***

Levasseur, D.G & Sawyer, K. (2006) explain that students who come to class with printed copies of slides have more time to cognitively process lecture material because the time spent in writing can be less than the listening one. Furthermore, providing slides may help students overcome the excessive cognitive load demands made by arousing PowerPoint presentations. But seldom it only has positive aspects, as it will be seen in the next sections, where instructor-provide slides affects in the taking notes, attendance and the performance of students (Worthington & Levasseur, 2015).

1)The note-taking

The note-taking has the function as external storage and the encoding function. The first one is defined as the storing course content so that students can later review that preparation for course exams and assignments. The second one refers to the learning that takes place as students actively record and translate course lectures into course notes, William & Eggart (2002, cited in Worthington & Levasseur, 2015). This last can be enhanced by slides.

The provision of the slide to students before lectures has distinct implications depending on whether the slides contain full notes or partial notes of the course. Concretely, who have slides with partial notes are required to adopt the role of active learner since they have to complement slides with the information given by the instructor. The contrary happens with full notes, situation in which students become passive learners or even when they know they will not have access to a copy of slides, situation in which they write literally the content of PowerPoint.

2)Attendance

Attendance is less likely when students have access to the handout of slides with full notes before or after the lecture. Moreover, if instructors use PowerPoint as a lecture tool instead of a supportive tool, then, there is not a real need to attend to class. In the review done by Gurrie, C. & Fair, B., (s.f) cites coming from students*:"everything I need to know is on the slides"*, reflects this fact. In contrast, if the online slides are provided with partial notes, students should attend to class.

3)Performance

It would seem that slides with partial notes improve learning outcomes but the results obtained do not support that. It is suggested this could be understood in the sense that despite of being university students, not all have the skill to take good notes (Levasseur, D.G & Sawyer, K., 2006). Nevertheless, the access to the partial notes of the lecture enhances the attention of students and their accumulation of notes. (Worthington & Levasseur, 2015)

2.2 Differential between the lowest and the uppermost course of the degrees

In the lowest course of the degrees, instructors provide slides with the aim students learn how is the structure of the content of the course (Roheling,P.V. & Trent-Brown, S.,2011). Whereas in the uppermost course, it is supposed students have the skills to organise and obtain reliable information from articles and handbooks by themselves. Then, teachers tend not to supply the slides. Furthermore, the role of instructors of the last year (4th) is as guide of the learning process, who promote discussions in class and clarify complex aspects of the content.
In contrast, in 1st year, teachers are seen as an authority figure who transmit knowledge. Provided that students do not have good skills yet to look for further information in other fonts, they pay more attention to the teacher than PowerPoint while in the 4th year this behaviour changes (Roheling,P.V. & Trent-Brown, S.,2011).

3. OBJECTIVES AND HYPOTHESES

Taking everything into consideration, there is a great need of research on how all the factors mentioned affect the perceptions of students. Thereupon, in this current study, it will be analysed their perceptions about the usage of PowerPoint their teachers do focusing on its supporting use. Research hypotheses have been formulated as follows:
(1a)The use of PowerPoint is generalized in High School and University (1b) although its usage is higher at University.
(2)Within a degree PowerPoint that is more present in the lowest course than in the uppermost course.
(3a) The frequency of use and the (3b) type of design of PowerPoint varies among university disciplines.
(4) The type of design of PowerPoint is used affect to the next variables: taking notes, attention, thinking, feeling of learning, attendance, understanding of the content and key concepts of lectures.

4.METHOD

Participants

A sample of 600 students (n=600) divided in 200 students from IE Costa LLobera High school and 400 from different faculties of UAB. The first category (n=200) includes the next levels: upper level courses of Secondary school and Baccalaureate whereas, the second category (n=400) consists on the first and the last course of several degrees belonging to Health's Science, Pure Science, Social Science, Education and Engineering disciplines. All these students are taking a course during the academic year 2014-2015. Being aware of the individual differences among the subjects, it has been decided to put them aside of the data collection and data analysis.

Instruments: Data Collection

A questionnaire* designed on purpose was used to evaluate the perception of students about the use of presentations by their teachers. It had a set of 12 queries which were translated and adapted to the Catalan language from Roehling & Trent-Brown survey (2011). Likewise, the catalan vocabulary and expressions for the students of IE Costa i LLobera High School gence slightly differ from university questionnaire.

**These questionnaires are attached in the annex.*

Procedure

High School

Firstly, a permission of the psycho-pedagogue from High School was requested to deliver the questionnaires to students together with the agreement of professors . The former questionnaire was distributed among the subjects during the first 10 minutes of their respective classes, always with the tutor's presence. Furthermore, students have received a brief summary about the goal of this research.

University

An attested copy provided by the department of Basic, Developmental and Education Psychology was shown to the voluntary instructors who accepted and decided to collaborate in our research. The following steps were the same as in the procedure at High School.

Statistical Analysis

The responses of those whose opinions were sought were used to determine what is the real use of presentations inside the classrooms. Moreover, the responses were subjected to an univariate analysis of variance ANOVA with the goal of checking whether there were any differences between the type of design of PowerPoint displayed among the five university disciplines analyzed (design and discipline). Furthermore, fifteen Chi-square were conducted in order to know how fourteen variables were affected by the usage of Presentations. The statistical SPSS v.20 was used with these goals.

Ethical Considerations

Private information of each participant was kept safe. Besides, whoever was invited to participate in this research had the right to deny his/her collaboration.

5.RESULTS

In total, 600 students completed the questionnaire. The overall scores are based on their perception about how teachers use presentations (Powerpoint in University and Open Office Impress at High School).

Which is the usage of Powerpoint in High School and University?

Hypothesis 1a is supported by the results.Nearly 90% of the participants, specifically 89,9%, informed presentations are used by their teachers in class, being always (47,1%), in more than 50% of them (21%) or less (21,7%). Nevertheless, just a 10,2% of students reported the usage didn't take place.

Table 1
Descriptive results of the usage of PowerPoint by instructors at High School and University.

	Frequency (classes)

	Always	More than half	Less than half	Never
Perception of the PowerPoint teacher's use by students (n=600)	283 (47,2%)	126 (21%)	130 (21,7%)	61 (10,2%)

Which is the frequency of PowerPoint's use in High School in contrast University?

The usage of presentations in High School (3rd-4th of E.S.O and 1st-2nd of Baccalaureate) present an opposed tendency than University (χ^2=309.85, df=3, n=600, p=.000)**.**
Whereas 69,8% of participants from University disclosed that presentations are always displayed, it highlight the 2% of High School students who inform about it. Taking into account the three categories where OpenOffice Impress/Powerpoint appears ('always', 'more than half' and 'less than half), represents 70,3% in High School and almost 100% (99,6%) in University. However, it's necessary to clarify that in High School this percentage is higher since 43,7% of participants reported OpenOffice Impress was used in less than 50% of the classes. Then, the *hypothesis 1b* is confirm.

Table 2
Frequency and percentatges of the usage of PowerPoint by teachers among High School and University students.

	Frequency (classes)				Statistics	
	Always	More than half	Less than than half	Never	χ^2 (df=3)	Sig.
High School (n=199)	4 (2%)	49 (24,6%)	87 (43,7%)	59 (29,6%)	309,850	.000
University (n=400)	279 (69,8%)	77 (19,3%)	42 (10,5%)	2 (0,5%)		

What is the usage of Powerpoint between the lowest level course (first course of degree) and the uppermost level course (fourth course of degree)?

Differently at what we expected *(hypothesis 2)*, we found that the use of Powerpoint is significantly higher (χ^2=26.29, df=3, n=300, p=.000) in the uppermost level course (83,3%) than the lowest one (59,9%). However, if we allow for the three categories which represent the presence of PowerPoint: 'always', 'more than half' and 'less than half' the resultant percentage of the difference is slightly higher, fourth course (99,4%) in contrast with the first (99,2%).

Table 3

Frequency and percentatges of the use of PowerPoint by teachers among the initial and last course of degrees.

	Frequency (classes)				Statistics	
	Always	More than half	Less than half	Never	χ^2 (df=3)	Sig.
1st Course (n=232)	139 (59,9%)	58 (25%)	34 (14,7%)	1 (0,4%)	26,285	.000
4th Course (n=168)	140 (83,3%)	19 (11,3%)	8 (4,8%)	1 (0,6%)		

d)How is the use of Powerpoint between university disciplines?

The differences showed by students' responses are statistically significative (χ^2=167.49, df=12, n=380, p=.000), being *hypothesis 3a* demonstrated. Powerpoint is mainly used in classes of Pure Sciences (98,3%) followed by Health Sciences (96,7%), Education (78,1%), Social Science (49,2%) and Engineering (32,5%).
It is important to remark any student reported that his/her teacher never uses Powerpoint, except in Social Sciences.

Table 4
Frequency and percentatges' differences of PowerPoint teachers'use among the university disciplines.

Disciplines	Frequency (classes)				Statistics	
	Always	More than half	Less than half	Never	χ^2 (chi-square)	Sig.
Social Sciences (n=61)	30 (49,2%)	12 (19,7%)	18 (29,5%)	1 (1,6%)	167,487	.000
Education (n=64)	50 (78,1%)	14 (21,9%)	0 (0%)	0 (0%)		
Health Sciences (n=61)	59 (96,7%)	2 (3,3%)	0 (0%)	0 (0%)		
Pure Sciences (n=117)	115 (98,3%)	2 (1,7%)	0 (0%)	0 (0%)		
Engineering (n=77)	25 (32,5%)	36 (46,8%)	16 (20,8%)	0 (0%)		

e) What type of Powerpoint design is displayed between university disciplines?

The results show there is a meaningful relationship amid the university discipline and the specific design of PowerPoint that is used *(hypothesis 3b).* Graphic design (F=4.45, p=.002), drawing design (F=15.04, p=.000) and Textual (F=5.29, p=.000).

Graphic design

Graphic design is more used in Social Sciences than Education ($\bar{x}$ =7.02, SD= 1.79, p=.005). and Health Sciences ($\bar{x}$=5.83, SD=1.83, p=.004).

Drawing design

Drawings are less frequent in PowerPoint of Social Sciences than in Health Sciences ($\bar{x}$=-13.051, SD=2.55, p=.000). Contrasting Education with Health Sciences and Pure Sciences it is seen that images are less frequent too. In the first case ($\bar{x}$=9.61, SD=2.51, p=.006) while in the last ($\bar{x}$ =-10.25, SD=2.16, p=.000).

Other resultant differences happen on the one hand between Health Sciences and Engineering, being 9 times more used than the former discipline ($\bar{x}$=8.96, SD=2.4,p=.008).

Finally, in Engineering, Powerpoint is 10 times less used than in Pure Sciences ($\bar{x}$=9.6, SD=2.03, p=.000).

Textual design

Within the textual category, Engineering is 15 times more displayed than in Health Sciences ($\bar{x}$=-15.24, SD=3.92, p=.005) and 12 times in comparison to Education discipline ($\bar{x}$=11.53, SD=3.32, p=.018).

Table 5

Statistical mean differences of the desings of PowerPoint among university disciplines

			Statistics			Anova	
Design			Mean	Std. Deviation	Sig.	F	Sig.
Graphic	Social Sciences	Education	7,024	1,796	.005	4.446	.002
		Health Sciences	5,832	1,826	.039		
Drawing	Social Sciences	Health Sciences	-13,051	2,549	.000	15.038	.000
		Pure Sciences	-13,689	2,211	.000		
	Education	Health Science	-9,613	2,508	.006		
		Pure Science	-10,252	2,164	.000		
	Health Sciences	Engineering	8,960	2,396	.008		
	Pure Sciences	Engineering	9,598	2,032	.000		
Textual	Health Sciencies	Engineering	-15,244	3,916	.005	5.293	.000
	Engineering	Ciències	11,532	3,322	.018		

f) What differences are reported among disciplines regarding the variables coming from the administered questionnaire?

The content of the lecture

In all the disciplines more than 50% students reported Powerpoint helps them to understand what is explained in lectures (χ^2=23.23, df=8, p=.003) and also to identify the key concepts (χ^2=17.54, df=8, p=.025).

The thinking

Referring to it, Powerpoint does not make interferences in students' thinking (χ^2=13.73, df=4, p=.008) and nor promotes a critical thinking (χ^2=7.54, df=4, p=.110), with the exception of Health Sciences.

Students' performance

The students' performance includes their participation, attendance and their note-taking. The two first are not affected, but without statistic significance, by the use of PowerPoint (χ^2=17.31, df=8, p=.027; χ^2=9.07, df=8, p=.34 respectively). Notwithstanding, the note-taking decreases with its presence ($\chi^2$54.12, df=8, p=.000).

Keep the attention

The attention is also without statistic significance, positively improved by the presence of Powerpoint in class. On the one hand, Powerpoint helps to be attentive to the displayed content on it (χ^2=11.2, df=8, p=.190) likewise to the teacher's talk (χ^2=4.33, df=4, p=.36). Regarding this, in Education (56,3%) and Pure Sciences (51,3%) do not follow the last claim. Carrying on attention, the main design that contributes to focus it to the lecture is chiefly the schematic one (χ^2=32.4, df=12, p=.90). The percentages vary from 36% to 52% among the disciplines. Despite this fact, students of Pure Sciences informed keeping more attention to the lecture when PowerPoint was not present (38,8%). Graphic content is in several disciplines the second option at which students pay attention.

Feeling of Learning

In spite of the fact it is not significant (χ^2=13.69, df=8, p=.08), the use of PowerPoint as a supportive tool is the one with higher scores considering all the disciplines with a range of percentages from 80,3% to 96,7%.

After all these results seen, the 4th hypothesis formulated is confirmed in the most the variables except feeling of learning, participation, attendance and thinking.

Table 6

Chi-square analyses of variables from the administrated questionnaire related to the use of Powerpoint.

		Disciplines					Statistics	
Variables	Frequency	Social Sciences	Education	Health Sciences	Pure Sciences	Engineering	χ^2 (chi-square)	Sig.
P4	Few times	7 (11,5%)	8 (12,5%)	1 (1,6%)	11 (9,4%)	15 (19,5%)		
	Often	38 (62,3%)	49 (76,6%)	50 (82%)	81 (69,2%)	57 (74%)	23,233	.003
	Always	16 (26,2%)	7 (10,9%)	10 (16,4%)	25 (21,4%)	5 (6,5%)		
P5	Few times	5 (8,2%)	4 (6,3%)	4 (6,6%)	12 (10,3%)	8 (10,4%)		
	Often	32 (52,5%)	48 (75%)	40 (65,6%)	74 (63,2%)	60 (77,9%)	17,536	.025

	Always	24 (39,3%)	12 (18,8%)	17 (27,9%)	31 (26,5%)	9 (11,7%)		
P6	Yes	25 (41%)	14 (21,9%)	32 (53,3%)	41 (35,7%)	31 (40,3%)	13,726	.008
	No	36 (59%)	50 (78,1%)	28 (46,7%)	74 (64,3%)	46 (59,7%)		
P7	Yes	16 (26,2%)	30 (46,9%)	24 (39,3%)	37 (31,9%)	24 (31,2%)	7,536	.110
	No	45 (73,8%)	34 (53,1%)	37 (60,7%)	79 (68,1%)	53 (68,8%)		
P8	Less notes	30 (50%)	40 (62,5%)	49 (86%)	88 (77,9%)	57 (74%)	54,122	.000
	Literal copy notes	27 (45%)	21 (32,8%)	4 (7%)	9 (8%)	10 (13%)		
	Not taking notes	3 (5%)	3 (4,7%)	4 (7%)	16 (14,2%)	10 (13%)		
P9	Increase students' questions	18 (29,5%)	11 (17,2%)	13 (21,3%)	16 (13,7%)	10 (13%)	17,314	.027
	No effect	35 (57,4%)	33 (51,6%)	40 (65,6%)	76 (65%)	45 (58,4%)		
	Decresase students' questions	8 (13,1%)	20 (31,3%)	8 (13,1%)	25 (21,4%)	22 (28,6%)		
P10	Increases the assistance	9 (14,8%)	4 (6,3%)	7 (11,5%)	8 (6,8%)	6 (7,8%)	9,070	.336
	No effect	35 (57,4%)	38 (59,4%)	41 (67,2%)	82 (70,1%)	46 (59,7%)		
	Decrease	17 (27,9%)	22 (34,4%)	13 (21,3%)	27 (23,1%)	25 (32,5%)		
P11	Help to be attentive	28 (45,9%)	32 (50%)	26 (42,6%)	50 (42,7%)	29 (37,7%)	11,203	.190
	No effect	13 (21,3%)	11 (17,2%)	23 (37,7%)	28 (23,9%)	25 (32,5%)		
	Makes be attentive difficult	20 (32,8%)	21 (32,8%)	12 (19,7%)	39 (33,3%)	23 (29,9%)		
P12	Yes	31 (50,8%)	28 (43,8%)	36 (61%)	57 (48,7%)	42 (54,5%)	4,333	.363

	No	30 (49,2%)	36 (56,3%)	23 (39%)	60 (51,3%)	35 845,5)		
P13	Textual Content	10 (16,4%)	5 (7,8%)	1 (1,7%)	12 (10,3%)	7 (9,1%)		
	Schematic	31(50,8%)	30 (46,9%)	31 (51,7%)	43 (37,1%)	28 (36,4%)		
	Graphic content	5 (8,2%)	10 (15,6%)	18 (30%)	16 (13,8%)	22 (28,6%)	32,398	.001
	Without Power	15 (24,6%)	19 (29,7%)	10 (16,7%)	45 (38,8%)	20 (26%)		
P14	Only Power	1 (1,6%)	1 (1,6%)	1 (1,6%)	4 (3,4%)	3 (3,9%)		
	Supportive Tool	49 (80,3%)	57 (89,1%)	59 (96,7%)	91 (78,4%)	62 (80,5%)	13.69	.090
	Without Power	11 (18%)	6 (9,4%)	6 (9,4%)	21 (18,1%)	12 815,6%)		

5.LIMITATIONS AND FUTURE RESEARCH

This study has a several limitations that should be taken into account. First of all, our sample includes just 2 degrees of each discipline, decreasing the variability of possibles answers. Besides, within this disciplines the courses chosen have been the lowest of the degree (the first year) and the uppermost course (the forth year). It just let have a general impression about the progress of the usage of PowerPoint by instructors in Higher Education.

Secondly, we did not take into account the different learning styles of students or their skills in the note-taking. Therefore, further research are need not only about the own variables or PowerPoint tool if not in the deepening of how students and teachers characteristics and styles of perform are making that Powerpoint is not as effective as it could be.

6. DISCUSSION AND CONCLUSIONS

PowerPoint or OpenOffice Impress (as its equal in Public High Schools), has a real presence in our Education system. However, its daily use in University in comparison with High School shows that in this last, the introduction of ICT is increasing slow although progressive. It may be as a result of the European Educative Approach- with the implementation of Bologna system and the students exchanges through the Erasmus programme- who has created the need to stay at the same level- referring to technology practices-than the rest of European Countries.

Then, PowerPoint is generally understood by teachers as one more tool which plays a role in their lectures.

We thought the use of PowerPoint would be lower in students who were in their last year provided that they have already got the skills to organise and structure the content of the course which generally is complemented with external information. Nevertheless, as it was seen in the review of literature, this unexpected results could be explained by the frequency of the discussion of complex ideas in the

uppermost course. These ideas are easier to understand and retain- considering the principles of dual coding theory-with both, visual and verbal information at the same time. Therefore, PowerPoint is more necessary to displayed in this level course.

Among disciplines, the predominant type of design of PowerPoint slides corresponds to the same found in their professional world. In Engineering is the textual design (with alphanumeric code) the most displayed. In social Sciences is the graphic design since their sector is usually working with numbers and statistic data. Finally, in Pure Sciences and Health Sciences drawing design is the main used which is useful to represent in a significant manner complex and abstract concepts.

It has to be highlighted that in Education it would be normal to expect that graphic design was the principal used. The reason is that teachers from this discipline are aware what is the best for students learning. Furthermore, attending to the fact that in the sample of this study the degree of Pedagogy was included, the results should have to follow the best pedagogical recommendations at the time to use the PowerPoint tool, being newly the theory of Paivio and the cognitive load theory the base for their application.

During the lecture, the presence of PowerPoint supports the talk of the teacher above all when Presentations has predominantly graphic-schematic design, where visual and verbal content are integrated. According to the theories of Paivio and Sweller (cited in Van Bruggen, J.M., Kirschner, P.A., Jochems, W.,2002), this type of design reduces the cognitive load the students have to process, facilitating then the learning process. This previous content need to be explained by the teacher to be understood while at the same this content helps to reduce the abstractions of his/her mental schema of knowledge. Then, Presentations with PowerPoint software often help students to understand easier the meaning of key concepts and their interrelationships which are framed inside different theoretical frameworks.

The students note-taking decreases with the display of computer-generated slides but this does not imply a drop in its quality. It may be diminished because (1) Have printed the slides facilitates a fast elaboration of the information. (2) In case the teacher not have supplied the slides before the lecture (although having the intention to do it after the class), students just take notes about what is more relevant or difficult to understand.

In addition, they don't boost critical thinking in the thought of students. Behind critical thinking, there is a teacher who inspires his/her students with their knowledge, with the way he/she transmits his/her feelings about it in verbal and nonverbal communication processes and also the effective use he/she does of ICT and other tools always with pedagogical aims in mind.

It can not be assured PowerPoint has a positive neither a negative effect on the following variables: attendance, interference of students thought, the attention to the teacher and the material as the statistical results show. Provided that individuals differences of students as a learners and of the teachers as communicators define a wide range and play an important role with multiplicity of interactions.

Finally, it is important to highlight that Cladellas et al (2013) carried on a research with students of Psychology degree from University Autonomous of Barcelona, the same university of our students sample. Consequently, the confirmation and the refutation of this previous hypothesis not only may be useful for Educational community but also for this institution.

7.ACKNOWLEDGEMENTS

We would like to thank the department of Basic, Developmental and Education Psychology of UAB for providing the material and the space needed to carry on this research.

We also thank all the instructors of degrees of UAB who have participated and Mercè Martín, psychologist of secondary school at IE Costa i Llobera, for giving us the permission to do our research in her educational center.

8.REFERENCES

Area, M., Cepeda, O., González, D., Sanabria, A., (2010). Un análisis de las actividades didácticas con TIC en aulas de educación secundaria. *Revista de Medios y Educación.* 38, 187 - 199.

Badia, A., Meneses, J. , Sigalés, C. (2013). Percepción de los docentes sobre los factores que afectan el uso educativo de las TIC en el aula equipada de tecnología. *Electronic Journal of Research in Educational Psychology*, *11*(31), 787-808.

Caird, S., Lane, A., (2013). Conceptualising the role of information and communication technologies in the design of higher education teaching models used in the UK. *British Journal of Education Technology*. doi: 10.1111/bjet.12123.

Cladellas, R. (1996). Las imágenes mentales: El modelo de Kosslyn. En D. Sáiz, M. Sáiz, J.Baqués (Ed.), *Psicología de la Memoria: Manual de Prácticas* (pp. 217-226). Barcelona, España: Avesta.

Cladellas, R., Castelló, A., Badia, M., Cirera, M., (2013). Effects of the PowerPoint methodology on content learning. *Intangible capital*, *9*(1), 184-198.

Coll, C., Rochera, M., Colomina, R. (2010). Usos situados de las TIC y mediación de la actividad conjunta en una secuencia instruccional de educación primaria. *Electronic Journal of Research in Educational Psychology*, *8*(2), 517-540.

Conboy, C., Fletcher, S., Russell, K., Wilson, M., (2012). An evaluation of the potential use and impact of Prezi, the Zooming Editor Software, as a tool to facilitate learning in Higher Education. *Innovations in Practice*, 7, 31-45.

Ellis, J. (2003). *Human learning.* New Jersey, USA: Prentice Hall. Traducción Castellana: *Aprendizaje Humano. Madrid, España: Pearson Prentice Hall.*

Estaún, S. (1996). Las representaciones mentales: la teoría dual. La contribución de Allan Paivio. En D. Sáiz, M. Sáiz, J.Baqués (Ed.), P*sicología de la Memoria: Manual de Prácticas* (pp. 227-234). Barcelona, España: Avesta.

Flores, O., et al. (2011). Web 2.0 en la docencia universitaria: aprendizaje colaborativo a través de la tecnología. Electronic Journal of Research in Educational Psychology, 24, 9(2), 931-960.

García, M., Romero, M. (2009). Influencia de las Nuevas Tecnologías en la evolución del aprendizaje y las actitudes Matemáticas de Estudiantes de Secundaria. *Electronic Journal of Research in Educational Psychology*, 17, *7*(1), 369-396.

Gurrie, C., & Fair, B. (2010). PowerPoint-from fabulous to Boring: The Misuse of PowerPoint in HIgher Education Classrooms. *Journal of the communication, Speech and theatre association of North Dakota, 23*, 30-37.

Joseph, J., (2012). The barriers of using Education Technology for Optimizing the Educational Experience of Learners. *Procedia-Social and Behavioral Sciences*, 64, 427-436.

Levasseur, D.G, & Sawyer, K. (2006). Pedagogy Meets PowerPoint: A research review of the effects of computer-generated slides in the classroom. *The Review of Communication, 6*(1-2), 101-123.

Livingstone, S., (2012). Critical reflections on the benefits of ICT in education. *Oxford Review of Education*, *38*(1), 9-24.

Llomäki, L., (2011). Does Gender Have a Role in ICT among Finnish teachers and students?. *Scandinavian Journal of Educational Research*, *55*(3), 325-340.

Negro, V., Del Campo, J.M., Nuñez, M., (2012). The history of technology in education. A comparative study and forecast. *Procedia-Social and Behavioral Sciences,* 69, 1086-1092.

Roehling, P.,& Trent, S. (2011). Differential use and benefits of PowerPoint in upper level versus lower level courses. *Technology, Pedagogy and Education, 20*(1), 113-124.

Savoy, A., Proctor, R.W., & Salvendy,G.(2009). Information retention from PowerPoint and traditional lectures. *Computers and Education, 52*, 858-867

Strasser, N., (2014). Using Prezi in Higher Education. *Journal of College Teaching & Learning*, *11*(2).

Suriá, R. (2010). Las TIC en las titulaciones universitarias de grado: análisis del conocimiento y uso del alumnado de la Universidad a Distancia. *Electronic Journal of Research in Educational Psychology*, 22, *8*(3), 1179-1200.

Van Bruggen, J.M., Kirschner, P.A., Jochems, W. (2002). External representation of argumentation in CSCL and the management of cognitive load. *Learning and Instruction, 12*, 121-138.

Wong, E., Li, S., (2008). Framing ICT implementation in a context of educational change: a multilevel analysis, school effectiveness and school improvement. *An International Journal of Research, Policy and Practice*, *19*(1), 99-120.

Worthington, D.L, & Levasseur, D.G (2015). To provide or not to provide course PowerPoint Slides? The impact of instructor-provided slides upon student attendance and performance. *Computers and Education, 85*, 14-22.

Yang, H., (2012). ICT in English schools: transforming education?.*Technology, Pedagogy and Education*, *21*(1), 101-118.