The education of the future: the students' perspective. Validation of a scale

La educación del futuro: perspectiva del alumnado. Validación de una escala

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Keywords
Future education, teacher 3.0, pupil 3.0, educational methodology 3.0, learning 3.0

ABSTRACT

This article presents a study which aims to validate and optimize a scale of evaluation of the education of the future from the perspective of the students. To this end, we took a sample of 431 students on different degree courses at the University of Huelva (Spain). An ad hoc scale designated 'Future education' was drawn up for data collection, designed to assess the beliefs of students on the education of the future. Then the instrument was validated by Cronbach's alpha and the unidimensionality of the different subscales conducting a factorial analysis of principal components was assessed. The results corroborate that the proposed dimensions (context, teachers, methodology, students and competences) are unifactorial. The skills to be acquired in the future are strongly linked to life in virtual environments.

Palabras clave
Educación del futuro, profesor 3.0, alumno 3.0, metodología docente 3.0, aprendizaje 3.0

RESUMEN

Este artículo presenta un estudio cuyo objetivo es validar y optimizar una escala de evaluación de la educación del futuro desde la perspectiva de los alumnos. La muestra se conformó de 431 alumnos pertenecientes a diferentes titulaciones de la Universidad de Huelva (España). Para la recogida de datos, elaboramos una escala denominada "La educación del futuro", que pretende evaluar las creencias del alumnado sobre la educación del futuro. El instrumento se validó mediante un alfa de Cronbach, y la unidimensionalidad de las subescalas se valoró con un análisis factorial de componentes principales. Los resultados corroboran que las dimensiones propuestas (contexto, profesores, metodología, alumnos y competencias) son unifactoriales. Las competencias a adquirir en el futuro están fuertemente vinculadas a la vida en entornos virtuales.

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INTRODUCTION

We currently live connected and we do not conceive sitting down to work without turning on the computer and accessing the Internet. Any individual, young or senior, is tethered to his/her smartphone 24 hours a day. Access to information and communication defines our current society and education. Even in more formal settings when we arrive to the classroom, we turn on the technological desk and our students place their laptops, tablets and smartphones on their desks. We observe substantive differences regarding university from the beginning of this century to nowadays.

The purpose of this research is to reflect and to put our ideas on future education (Suárez-Rodríguez *et al.*, 2012) to the test. Technological context, professors, teaching methodology, students, learning and future competences are in this research dimensions being assessed from the student standpoint. To do so, we have developed a scale which validation will be presented in this paper.

The technological setting of education in the year 2000 was Web 1.0 or information Web. The users access the Internet to consult information posted mainly by organizations, institutions and enterprises; however, personal authorship webs were scarce. On the other hand, we had to install proprietary software applications in our computers.

In 2015, Web 2.0 transformed the uses and, above all, the concept of Internet. More than ever the Internet now allows bidirectional flows of information of not only communication, which is quite extensive in this decade, but also of information and contents developed, published and shared by individuals. Commoners and well-known people feed this maze of universal data with texts roughly elaborated, photographs, videos, sounds, comments, opinions, open consultations, announcements, calls, theories, musings, reports, among others. Nothing is protected against the image, comment or analysis. There are no taboo nor professional, scientific field, individual or esoteric topics free from information, disinformation or interpretation.

Never before has information worth so much – and so little - and it has never been so democratic. Citizen journalism, entertainment, web as platform, recommendations, collaborative filter, users' classifications, common creation, remix, sharing, collective intelligence, social software and social networks are words associated with Web 2.0 (O´Reilly, 2005; O´Reilly & Battelle 2009); however, so is junk information or semiotic trash (Correa, 2011).

On the other hand, even if many of us continue to be slaves of proprietary software applications installed in our computers, more applications and tools are increasingly available on networks to which we connect to carry out specific tasks (Lozano, 2008). Google, Gmail, Writely, Bloglines,

Del.icio.us, Flickr, Plaxo, among others, are network applications quite well reputed (Dans, 2008).

Concepts such as social web, peoples web, social software, generation network, blogosphere, collective intelligence, permanent beta and creative commons also define the reality of Web 2.0 (Fumero and Roca, 2007). More concretely in the educational environment, Web 2.0 is

> A change of paradigm about the conception of Internet and its functionalities which currently abandon their marked unidirectionality and tend more to facilitate the maximum interaction between users and the development of social networks (social technologies) from where they can express themselves and give their opinions, look for and receive information of interest, collaborate and create knowledge (social knowledge), share contents (Marqués, 2007, 2010).

We could ask ourselves where will the network be in 2020? Will there be a Web 3.0? Will there be a semantic web enriched with artificial intelligence? Will there be an Intelligent Social Web? (Fumero and Roca, 2007), Will there be a virtual "big brother"? Serving what, who, and what model of society?

In 2000, a university professor could stand out as a deep lecturer in his specialization; some included as researchers in their field and era, from the teaching standpoint, an organizer of didactic experiences, a learning mediator, always from the mastery of a subject and his/her certainly about it, whose personal rhetoric of in-class courses was, in turn, mediated by digital presentations. In 2015, a professor was either a researcher in his/her field or, at least a specialist in publishing in journals of impact. He/she would write manuscripts that sometimes fed the theory of our science. This tremendous task went along with that of teaching, and sometimes with the least important, which is that of mediator of learning and organizer of experiences, now with more virtual basis and digital material (Área, 2010), but this goes a little further, the professor also becomes a manager of knowledge (Bauerová and Sein-Echaluce, 2007).

Duart, Salomón and Lara (2006), when referring to the Universitat Oberta de Catalunya [Open University of Catalonia] make a distinction between professor, author of material, consultant and tutor. A professor is an individual that teaches how to learn, someone that accompanies students, who thinks of the way his/her students learn, that innovates his/her teaching; ultimately, a professor is a generator of learning (Cano, 2009). The new models of shared knowledge and distributed intelligence generate many uncertainties. A professor must know his subject which is not confined to more or less controlled references but rather to any information available on the Internet. He/she must also be competent technologically (audio, video, PC, Internet) and didactically with these resources. This brings him/her in offering countless teacher-training courses in presentations, videos, web page design, Internet for teaching, databases, digital library, tele-training platforms, material digitalization, assignment virtualization, electronic administration, among others.

Likewise, he/she must now be a 2.0 professor (Peña, Córcoles and Casado, 2006), that participates on social networks, that has a blog, that used wikis to create shared knowledge, that develops and uploads videos on the Internet. He/she is also a communicative professor that interacts with the other teachers and carries out virtual tutoring (Boza and Toscano, 2011).

How can we imagine a professor 3.0 in 2020? We would like to believe that this professor will be a thinker, a deep multidisciplinary lecturer, a critical observer of the reality, a multidisciplinary researcher with genuine scientific concern, a teacher that generates cognitive conflict, that propitiates questioning and divergence, a writer of his personal reflections and experiences, a manager of learning contexts, a coach of personal training projects, and perhaps a designer of learning objects. Ultimately, beyond contents and technologies, always short-lived, a professor will be a tutor, a counsellor, a coach of individuals.

What didactic methodology will this professor use? The professor in the year 2000 planned his courses from the curricular theory and developed his subject through knowledge, procedures and attitudes. Likewise, he/she worked by projects/problems and combined theoretical sessions with practical applications, group assignments more or less practical and would conclude with theoretical developments evaluated by means of written exams. There was a variety of didactic material which would come mainly from written sources.

As for the 2015 professor 2.0, he/she would work from an interdisciplinary perspective, he/she would plan his/her teaching action from the logic of the European convergence and organize active learning experiences from action competences (Área, 2010; Pérez, 2010). He/she would resort to collaborative research projects, real or fictitious. He/she would develop an interactive pedagogy that required participation, experimentation and co-authorship from the students that some would qualify of *remix curricula*, curriculum 2.0 (Selwyn, 2009), vague or blurred methodologies and *prêt à porter* pedagogies (Correa, 2011). His/her didactic material were more varied than those of the year 2000. They responded to a didactic multi-literacy, texts, hypertexts, images, sounds, besides other audiovisual material that would be incorporated to his/her habitual teaching. Many of these resources were available online through tele-training platforms; however, they were not interactive.

According to our students' comments, Web 2.0 is still the most common information transmission method used in education (Boza and Toscano, 2011). The methodology 3.0 we imagine for 2020 will be based on carrying out real action or research projects in real settings, specific to universities-enterprises. We will continue to organize teaching-learning experiences according to the development of action competences. Our students will have an integrated professional *practicum* (formation + internships) in line with a lifelong work-study integration concept. Flexibility,

personalization, interaction and cooperation will be the defining notes of that methodology.

Regarding the 2020 didactic materials, we can imagine them as an evolution of the current ones, i.e., more advanced. We conceive resources more as a process and result of a new shared, distributed, collaborative concept of learning management rather than new ones. Open educational resources, shared wiki-portfolios, academic-professional blogs; ultimately, 2.0 learning objects, fruit of personal learning environments mediated by professors that will be tutors who will accompany the students' individual and social development. Even so, the format and the technology will be the least important; contents and purposes will be of major importance.

Students 1.0 of the year 2000 would adopt the role of spectators. At best, they would see, reflect and make comments. At a lesser degree, they would also be processors of the material we would provide them (notes, books and presentations). They would sometimes look up to supplement some documentation on their own. They would transform this textual raw material into examinations, monographic work and some practical assignments, with a certain degree of criticism. Their basic work was in class: attending classes, participating and discussing.

As for students 2.0 (2011) they had to adopt a more constructive role, participate, discuss, read, do research, criticize, write, share, in a more virtual than in-class mode (Anguita *et al.,* 2009; Santos *et al.,* 2009); or according to the different sciences, observe, handle, transform and understand (Bauerová and Sein-Echaluce, 2007). They belonged to the Network generation. They depended on their laptops and their conenction to the Internet. They started organizing themselves in virtual work communities and practice *e-learning* 2.0, that we could synthesize in collecting, reflecting, connecting and publishing.

How do we imagine students 3.0 in 2020? Our students will be experts in the fast and intuitive processing of multiformat digital information they will transform into digital - collaborative or not – productions they will publish on their personal blogs or on their work networks; they will be capable of making decisions and intervening on the reality – with or without a certain audacity – based on very basic reflections extracted from this information. They will be very creative, fruit of the sensorial hyperstimulation they have experienced in their personal and academic life. They will be co-producers of knowledge (Selwyn & Gousetti, 2009), but said knowledge will be fundamentally pragmatic and contextualized.

The students of the year 2000 would develop a deductive learning above all and, at a lesser extent, an inductive learning, cooperative type, constructivist and active. In 2011, these characteristics broadened and diversified, and we could talk of learning communities and social learning (Del Moral and Villaustre, 2007), collaborative learning (García, 2009;

Díez, 2006; Martín and Alonso, 2009; Area, 2010; Pérez-Sanz, 2010), learning on Internet and constructivist learning (Díez, 2006), computer-support collaborative learning (Anguita *et al.,* 2009), learning through search and learning by doing (Santos *et al.,* 2009), active learning experiences, problem-based learning (Gimeno and García Laborda, 2009), significant learning, conversational learning, learn learning, customized learning, open and democratic learning (Selwyn & Gousetti, 2009), *e-learning* 2.0 (Duart *et al*., 2006; Del Moral and Villaustre, 2010), informal learning (Selwyn and Gousetti, 2009; Del Moral and Villaustre, 2010), chaotic learning (Del Moral and Villaustre, 2010), interactive learning (Arenas *et al.,* 2009), hybrid learning (Duart *et al*., 2006; Arenas *et al.,* 2009; Cabero, 2011) and magic learning (Aparici, 2000).

For 2020, we imagine that our students 3.0 will develop above all research learning and will combine deductive and inductive processes. This type of learning will generate new knowledge that does not only assimilate or rebuild knowledge already developed. It will be a hyper symbolic learning, the result of a participative action in contexts rich in images, texts, sounds and animations (Fombona and Pascual, 2011), developed on the Internet from a model that can oscillate between an absolutely protocolized model (if the current tendency of assessing quality is maintained) and another model that we could define as chaotic-productive, proper to communities of young learners, multidisciplinary, non-hierarchical but motivated according to the results-products, personal model of the creative e-enterprises. Learning 3.0?

What competences do our students develop in such setting? The university of the year 2000 required only that their students acquire technical-professional cognitive competences (knowledge) related to a specific professional environment, and procedural competences (skills, know-how, know how to apply the knowledge to professional situations). The 2015 university required from her students participative and social competences (know how to be, attitude and skills for dialogue, capacity to collaborate in groups), and personal competences (know how to be, self-knowledge, know how to act according to one's principles, assume responsibilities, make valid decisions, face frustrations, maintain a balanced conduct) (Echeverría, 2005).

More specifically, in the academic environment 2.0, besides the structural competences in the Tuning Project (2003) for the EHEA [European Higher Education Area](instrumental, interpersonal and systemic), our students must develop competences that look for and select information; reconstruct, develop and diffuse information; communicate and work collaboratively; rebuild knowledge (Area, 2010); acquire awareness of the information and its flows; resolve complex problems; connect to the Internet and assess one's personal creations (Jobb, 2008, quoted in Barberà, 2008); know how to collect information, reflect on it, and publish one's personal developments; be able to listen, converse and influence

(Fumero and Roca, 2007); and have an entrepreneurial spirit (Duart *et al.*, 2006).

A last note on our experience: students do not know how to write on paper. What are the competences students of 2020 need to develop? Without disregarding none of the above, we imagine the student 3.0 integrated in a collective intelligence distributed on the Internet; capable of shaping, maintaining and defending his/her own personal identity in a pixelated world; a student that has learned to disconnect himself/herself from the virtual network; that makes conscious decisions even though they are virtual -digital, they are no lesser important and transcendental; that he/she relate socially by looking, talking, smiling and living in person.

Therefore, from the theoretical conceptualizations presented, we developed an instrument to measure the perception of the students regarding the education of the future. The object of this study is to share some analyses related to the validation of such instrument.

METHOD

OBJECTIVE AND HYPOTHESIS OF THE RESEARCH

The objective of this research is to validate an assessment scale of the education of the future from the students' perspective.

- Hypothesis 1: Our scale will have sufficient values (≥ ,8) of internal coherence (reliability)

- Hypothesis 2: Our scale will confirm the factors initially designed and will present a unidimensional structure in each subscale.

SAMPLE

The population object of our study are the students of the Universidad de Huelva [University of Huelva] in Spain. The sample selected is of incidental type and consists of 431 students (37.5% male and 64.4% female), belonging to different university degrees, aged between 19 and 35 (M=23,07; DT=2,77). As for personal technological data, we can say that 98.8% have e-mail, 96.5% usually surf the Internet, 95.1% use tele-training platforms (Moodle or similar platforms), 93.3% use social networks (Facebook, Tuenti and Twitter), 87% use Internet applications (Gmail, Google doc, Flickamong others), 86.5% have published something on the Internet, 86.3% use chat and 84.9% participate in forums, 75.2% use social markers, 72.4% have used some wiki tools, 55.2% say having a blog, 51.3%

share audio files and 50.8% resort to virtual tutoring; however, only 31.3% have a personal or professional web.

INSTRUMENT

To collect the data we developed an *ad hoc* scale coined "The education of the future" purporting to evaluate students' opinions on the education of the future. The scale was designed based on our own ideas (Suárez-Rodríguez *et al.,* 2012) which, in turn, were based mainly on conclusions extracted from other papers (van Deursen, van Dijk y Peters, 2017). This scale consists of six dimensions: a technological context (12 items), teachers of the future (15 items), future teaching methodology (11 items), students of the future (10 items), future learning (28 items) and competences of the future (16 items). The type Likert scale with values from 1 to 7 built on the theoretical framework was submitted to the opinion of experts (university professors and postgraduate students). We requested that these experts assess the relevance and the writing of items and we obtained satisfactory results from most of them. The scale was collected during cross-sectional training days conducted at the Universidad de Huelva [University of Huelva] and was given to the students on paper the first day of the sessions and collected during the two following weeks.

DATA ANALYSIS

First, we validated the instrument by means of two procedures; we studied the internal coherence (reliability) through the Cronback alpha and we identified the least coherent items in every one of the subscales proposed. Next, we assessed the unidimensionality of the different subscales through a factorial analysis of the main components.

RESULTS

RELIABILITY

After applying the Cronback Alpha to assess the internal coherence of the total scale and subscales, we obtained good values in every case. This allowed us to identify the less coherent items to review the scales and their improvement in future applications (See Table 1).

Table 1. Scale reliability, Cronbach Alpha

	Alpha	Less coherent items

Context	,833	CT1, CT2, CT3, CT10, CT11
Professors	,915	PF6
Methodology	,911	MD7
Students	,897	AL1
Learning	,941	AP1, AP7, AP17, AP19, AP20, AP23, AP24, AP26, AP27, AP28
Competences	,944	CO14, CO15
Scale	,971	

Source: Self development.

The less coherent items refer to the technological context and that of learning even though some items are observed in other dimensions.

FACTOR ANALYSIS

The purpose of the factor analysis is to assess the unidimensionality of the different scales through the method of main component extraction. The analysis is relevant given the high KMO scale indexes (Kaiser, Meyer y Olkin) with values between 0,831 and 0,946 that allow concluding the coherence of the factor analysis. Likewise, the Bartlett test of sphericity assessing the applicability of the analysis of all the scales, has a < 0.001 significance index; hence, the application of the factor analysis. The results regarding each one of the dimensions considered are as follows:

Technological context

Table 2. Factor analysis of the technological context

Matrix of the main components (KMO: 0.831; Bartlett, sig: 0.000)

	CF1-Technological context	CF2-Transforming context	CF3-Inforubbish
CT7. We use the Internet to give recommendations, opinions, assessments	.799	-.398	-.109
CT9. The Internet will allow to create and exercise a collective intelligence	.765	-.150	-.065
CT8. We will use the Internet to create in common, remix and share	.727	-.418	-.084
CT5. We will use the Internet to entertain ourselves	.700	-.301	-.029
CT12. The Internet will be more social, and will belong to the people	.665	.286	-.081
CT6. We will use the Internet as a platform (without installing programs)	.640	.031	.158
CT4. We will use the Internet to make citizen journalism	.619	.071	.160
CT2. I believe that the Internet will soon be an intelligent social web	.576	.376	-.215
CT3. The Internet may become the Big Brother that sees everything	.563	.437	-.297
CT1. Web 2.0 will transform the concept and use of the Internet	.458	.532	-.148
CT10. Social networks will continue being the most interesting element of the Internet	.183	.451	.723
CT11. There will be increasingly more inforubbish, semiotic rubbish on the Internet	.473	-.201	.630

Variance explained by factor	38.278	11.612	9.643

Source: Self development.

We identified three factors that explain the 59.53% of the variance (See Table 2):

- Factor 1 (CF1). Technological context. It describes a technological context characterized by the use of type Web 2.0 tools: give recommendations, opinions and assessments; create and exercise collective intelligence; create jointly, remix and share; entertain ourselves; social use and people web, use as a platform; make citizen journalism; intelligent social web and "Virtual Big Brother.
- Factor 2 (CF2). Transforming context. It defines the context in which the Web 2.0 will transform the concept and use of the Internet.
- Factor 3 (CF3). Inforubbish/Social networks. Specify the context saturated with semiotic rubbish which is mainly focused on social networks.

If we eliminate CT10 and integrate CT1 and CT11 in the first factor, which are also highly saturated, we would remain with only one factor which would confirm the unidimensionality of the subscale.

b) Professor of the future

Table 3. Factor analysis of the professor of the future

Matrix of the main components (KMO: 0.910; Bartlett, sig: 0.000)			
	PF1-Socio-critical	PF2-Didactic technological	PF3-Virtual tutoring
PF8. This professor will be a deep multidisciplinary professor	.816	-.215	.051
PF13. This professor will be a counsellor of personal training projects	.806	-.057	-.202
PF12. This professor will be a manager of learning contexts	.804	-.273	-.180

PF15. This professor will be a tutor, a counsellor, a people's guide	.779	-.063	-.207
PF9. This professor will be a multidisciplinary researcher that publishes for scientific interest	.764	.290	.194
PF7. This professor will be a thinker, a critical observer of the reality	.753	-.141	.001
PF14. This professor will be a designer of learning objects	.747	-.112	.020
PF10. We would like a teacher who generates cognitive and divergent conflicts	.739	-.228	-.017
PF11. This professor will write his/her own reflections and experiences	.679	-.456	-.103
PF2. This professor must be competent technologically (audio, video, PC, Internet)	.661	.522	-.217
PF3. We would like a professor that participates on social networks	.611	.428	.406
PF5. We would like a professor that communicates more with the students	.605	.372	-.292
PF4. We would like a professor that develops and uploads video on the Internet	.586	.389	.356
PF1.This professor must be didactically competent with these resources	.582	.607	-.115
PF6. Online tutoring is more comfortable that in-class tutoring	.351	-.096	.783
Variance explained by factor	48.433	10.845	8.112

Source: Self development.

We identified three factors that saturate the 67.39% of the variance of the set of variables (See Table 3):

- Factor 1 (PF1). Socio-critical guiding professor. It defines the professor of the future as a deep multidisciplinary lecturer, guiding personal training projects, manager of learning contexts, tutor and counsellor of people, multidisciplinary research, thinker, critical observer of the reality, designer of learning objects, generator of cognitive conflict, writer of his/her own reflections and experiences, competent technologically, participates on the social networks and communicates with students.
- Factor 2 (PF2). Didactically competent professor. It describes the professor as didactically competence with technological resources.
- Factor 3 (PF3). Virtual tutoring. It defines professor-student tutoring as online rather than in-class tutoring.

If we integrate PF1 in factor 2, in which it is also highly saturated, and eliminate PF6, we would have only one factor, which confirms this dimension.

c) Future Teaching Methodologies

Table 4. Factor Analysis of future teaching methodologies

Matrix of main components (KMO: 0.911; Bartlett, sig: 0.000)		
	MF1- Collaborative projects	MF2- socio-virtual
MD10. We will use interactive and co-developed learning objects	,833	,062
MD6. Educational resources will be open	,803	-,228
MD4. We would like to learn with different resources (texts, hypertexts, images, sounds)	,795	-,152
MD2. We would like to have an integrated professional *practicum*	,792	-,245

(training + internships) all along one's studies		
MD5. Learning will be shared, distributed, collaborative	,785	-,217
MD3. We believe that the work-study integration is for a lifetime	,770	-,216
MD11. The professor will encourage mediated personal learning environments	,766	,029
MD9. Professors will have academic-professional blogs	,764	,322
MD1. We want to carry out real action or research projects in real contexts.	,703	-,237
MD7. We will use social networks as a teaching - learning tool	,469	,663
MD8. We will use shared wiki-portfolios	,570	,649
Variance explained by factor	54,685	11,406

Source: Self development.

We extracted two factors that explain the 66.091% of the variance and they include the following variables (See Table 4):

- Factor 1 (MF1). Methodology of real collaborative projects. It defines a teaching methodology based on interactive and co-developed learning objects, open and diverse educational resources; an integrated professional *practicum* throughout the studies that fosters a shared, distributed and collaborative learning; lifelong work-study integration; mediated personal learning environments, academic-professional blogs and real action or research projects in real contexts.

- Factor 2 (MF2). Socio-virtual methodology. It describes a methodology based on communication and horizontal work with virtual support.

Once more, the two items of Factor 2 could be integrated in one given its weight, which confirms this dimension as unique.

d) Students of the future

Table 5. Factor analysis of students of the future

Matrix of main components (KMO: 0.857; Bartlett, sig: 0.000)		
	AF1- Social/ constructive	AF2- Pragmatic/ creative
AL2. We will get organized into virtual work communities	.788	-.306
AL3. We will be experts in fast and intuitive processing of multiformat digital information (texts, audio, images, video)	.759	-.367
AL4. We will transform the information into digital productions	.748	-.391
AL5. We will publish in individual or collaborative blogs	.727	-.375
AL6. We will work in multi-professional networks	.726	-.385
AL7. We will be able to decide and intervene on the reality based on information	.725	.145
AL8. We will be more creative, fruit of sensorial hyperstimulation experienced in our lives	.710	.538
AL10. This knowledge will be fundamentally pragmatic and very contextualized	.690	.509
AL9. We will be co-producers of knowledge	.684	.569
AL1. We will have a more constructive role (debate, read, research, criticize, write, share)	.658	.206
Variance explained by factor	52.193	16.052

Source: Self development.

We indicate two factors that saturate the 68.245% of the variance of the set of variables (See Tale 5):

- Factor 1 (AF1). Social-constructive student. It defines a constructive student organized in virtual learning communities and professional networks, processor and transformer of digital information, capable of making decision and intervening.

- Factor 2 (AF2). Pragmatic-creative student. It describes a pragmatic, creative student, coproducer of knowledge.

Here again, we are in fact before a unique dimension since AL8, AL9 and AL10 could be integrated into Factor 1

e) Future Learning

Table 6. Factor analysis of future learning

Matrix of main components (KMO: 0,935; Bartlett, sig: 0.000)					
	APF1-Act Soc Research	APF2-Chaotic product	APF3-by computer	APF4-informal	APF5-deductive
AP9. Learning by making active learning experiences	.804	-.149	-.100	-.115	.064
AP4. Developed in learning communities	.801	-.150	-.050	-.097	.094
AP11. Significant learning	.793	-.165	.071	-.041	-.043
AP15. Open learning	.792	-.113	.097	.205	-.137
AP21. Learning that generates new knowledge	.777	-.140	-.121	-.019	-.070

AP12. Conversational learning	.762	-.238	.238	-.173	-.075
AP6. Collaborative learning (with the support of a professor)	.761	-.319	-.074	-.095	-.135
AP5. Social learning	.756	-.194	-.077	-.137	.025
AP8. Discovery and research learning	.755	-.033	-.206	.032	.164
AP13. Learn learning	.743	-.325	.110	-.110	-.045
AP3. Constructivist learning	.742	-.197	.013	-.144	.079
AP2. Cooperative learning (among students	.722	-.209	.057	-.049	.086
AP10. Learning based on problems	.717	.023	.051	-.154	.139
AP22. Hyper-symbolic learning, rich in images, texts, sounds and animations	.704	.138	-.351	.024	-.022
AP14. Customized learning	.702	-.138	.293	.078	-.045
AP18. Interactive learning	.700	.062	-.155	.334	-.131
AP16. Democratic learning	.698	-.105	.248	.270	-.212
AP25. Developed in multidisciplinary learning communities	.603	.391	-.277	-.042	-.187
AP19. Hybrid learning (in-class + virtual)	.534	-.080	-.185	.455	.151

AP7. Computer supported learning	.530	.176	-.508	.123	.280
AP17. Informal learning	.500	.183	.470	.460	-.032
AP28. Developed in proprietary models of creative e-enterprises	.487	.422	.071	-.314	-.126
AP24. Developed through a chaotic-productive model	.250	.738	.161	.212	.095
AP23. Developed on the Internet from an absolutely protocolized model	.404	.653	-.207	.121	.142
AP27. Developed in learning communities motivated according to results	.448	.565	-.059	-.391	-.093
AP26. Developed in non-hierarchized learning communities	.451	.527	.145	-.051	-.260
AP20. Magic learning	.386	.470	.412	-.160	.056
AP1. Deductive learning (First theoretical and then practical)	.269	.045	.336	-.082	.771
Variance explained by factor	42.218	9.767	5.128	4.136	3.734

Source: Self development.

We identified five factors that explain the 64.983% of the variance of the set of variables (See Table 6):

- Factor (APF1)1. Active, social, research learning. It defines an active, significant, open, generator of new knowledge, conversational, collaborative, social, research, constructivist, cooperative, hyper-symbolic, customized, interactive, democratic, hybrid, informal, ICT supported learning

developed in multidisciplinary learning communities and based on problems.

- Factor 2 (APF2). Chaotic-productive learning. It defines a chaotic-productive learning developed on protocolized networks but non-hierarchized and based on results.
- Factor 3 (APF3). Learning through computer. Refers to computer supported learning.
- Factor 4 (APF4). Informal learning. Defines an informal learning.
- Factor 5 (APF5). Deductive learning. Specifies a deductive learning.

In fact, we are before a unique dimension (learning) with two factors (1 and 2). AP7 and AP28 saturate Factor 1 and we could disregard AP1.

f) Competences of the future

Table 7. Factor analysis of competences of the future

Matrix of main components (KMO: 0.946; Bartlett, sig: 0.000)		
	COF1- Learning Competences virtual environments	COF2- Social survival Competences
CO8. Reflect and remix of collected information	.830	-.051
CO6. Resolve complex problems	.820	-.006
CO7. Evaluate your own creations	.816	.008
CO5. Acquire awareness of the information and its flows	.804	-.089
CO16. Make conscious decisions which are transcendental despite being virtual	.802	.230
CO3. Communicate and work collaboratively	.801	-.076
CO12. Integrate oneself in a collective intelligence distributed on the Internet	.754	-.281

CO10. Capable of listening, converse and influence others	.754	.078
CO11. Have an entrepreneurial mindset	.718	.073
CO4. Rebuild knowledge	.707	-.211
CO9. Publish your own development	.702	-.076
CO2. Rebuild, develop and disseminate information	.696	-.419
CO1. Look for, select and collect information	.674	-.503
CO13. Customize, maintain and defend one's own individuality in a pixelized world	.658	.008
CO14. Learn to disconnect from the virtual network	.652	.485
CO15. Maintain an adequate work-leisure balance in a diffused, precarious labor scenario	.642	.476
CO17. Connect socially in person, live and directly	.628	.470
Variance explained by factor	54.160	7.768

Source: Self development.

We identified two factors that saturate the 64.983% of the variance of the set of the variables (See Table 7):

- Factor 1 (COF1). Learning competences in virtual environments. It includes all the variables that form this dimension (competences of the future) and which are related to all the strategies and processes that promote the implication and protagonism of the students in acquiring knowledge in virtualized societies.

- Factor 2 (COF2). Social survival competences. They exemplify variables that are related to the real social life as disconnected from the Internet, balancing work-leisure in a society that makes the distinction increasingly less, and which work scenario is more diffused and precarious, besides maintaining the capacity to relate socially in person.

Once more, we found a dimension with only one factor since the variables of the second factor saturate the first with values even higher than the latter. This second factor also aims at competences less cohesive (social survival competences) with those of the first factor (learning competences in virtual environments).

CONCLUSION

We drew conclusions regarding the achievement of objectives and responding to the research hypotheses.

Regarding the objectives, we thought that the assessment scales of the education of the future we proposed remained validated in its dimensions through the factor analysis. We also obtained positive reliability values.

Hypothesis 1: H1 is confirmed. Our scale has good internal coherence values, in most of the cases higher than .9. This is a good reliability indicator. Moreover, it allows us to locate the less integrated items in every one of the subscales and to assess their future permanency in them.

Hypothesis 2: H2 is confirmed regarding the dimensions of the context, professors, methodology, students and competences that are really unifactorial. Likewise, we corroborated in part the hypothesis regarding the learning dimension even though, in this case, it presents two factors.

The future technological context of education is defined by using the Internet that allows the participation by giving out opinions and assessing, creating and working as a collective intelligence, remixing and sharing information, and knowing how to differentiate the inforubbish. It also allows us to have fun and do citizen journalism; however, we must be aware that this means being digitally observed.

The model of the professor of the future, according to the contributions of López, González and León (2015), is profiled as an informed multidisciplinary professional, guide of personal training projects of the students, manager of contexts and designer of learning objects, people counsellor and coach, scientific researcher, thinker and critical observer of the reality, divergent and generator of cognitive conflict, communicator of his/her own reflections, competent in ICTs, socially active on networks and communicative with his/her students.

The didactic methodology of the future is configured around a model of collaborative research projects that solidifies the use of interactive and co-developed learning objects; open educational resources; a professional *practicum* integrated throughout the students' studies; a shared, distributed and collaborative learning; a work-study integration; the mediation of personal learning environments and the use of academic-professional blogs (Área, 2010; Pérez, 2010; Selwyn, 2009).

The model of the student of the future is being portrayed as constructive, organized in virtual learning communities and on professional networks, as a processor and transformer of digital information and capable of making decisions and intervening on the reality through projects. These findings are close to those of Santos *et al.* (2009), that highlight the student's more constructive and critical, that discusses, reflects and does research in a virtual more than in-class mode.

The learning of the future is characterized as being active, significant, open, a generator of new knowledge, conversational, collaborative, social, investigatory, constructivist, cooperative, customized, interactive and democratic, developed in multidisciplinary learning communities and based on problems. It is also hyper-symbolic, hybrid, informal and ICT supported.

The competences to acquire in the future are strongly linked to the life in virtual environments. It highlights collecting, reflecting and remixing information, resolving complex problems, assessing personal creation, being aware of the flows of information, controlling one's own digital identity, taking transcendental decisions even if they are virtual, as well as live and work in collaboration, integrated in collective intelligences; having the social skills to listen and convince others; besides developing entrepreneurial skills and publish personal works. Social survival competences are also necessary such as the capacity to disconnect from the Internet and balance one's leisure and work life in fluid work scenarios.

The confluence of data of both analyses allowed us to finally recommend the following items for the future use of the suppression scale: technological context (CT1, CT10, CT11), professor of the future (PF6) and learning of the future (AP1, AP20). We will not consider factors that have only one or two items as being part of the factor solution since they do not shed enough information. Regarding items that load onto more than one factor, they are incorporated in the factor which they saturate with higher values.

As this study limitations, we should point out the theoretical construct, remix between reality and desire with a certain prospective vision. This has generated imbalances in the design of the instrument, which is not a limitation but rather a work achievement. We also noticed as a restriction of the use of an incidental sample circumscribed in one university only, in spite we consider that it is adequate for an exploratory that has taken into

consideration at least the assessments corresponding to sex and graduation degrees.

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