



## Proposal of QR Codes Implementation in Teaching Methodology

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### Abstract

*The integration of the Information and Communications Technologies (ICT) in the classrooms contributes to improve the understanding of both, the concepts related to a specific subject and their teaching resources themselves, amplifies the possible teaching strategies and facilitates the preparation of the teaching materials. Moreover, with the almost unlimited source of teaching materials that internet brings, it is possible to tailor the different materials used to the students different learning needs, and even to make them accessible to students with learning difficulties associated to physical, sensory or intellectual limitations, this is, with Special Educational Needs (SEN).*

*Working on these principles, in this contribution the use of QR codes in teaching methodology to help SEN students is presented. The methodology implantation for this educational supporting tool should be adapted to the context, student characteristics and pedagogical principles to guarantee a significant learning.*

## 1. Introduction

### 1.1 Background information

The application of the Normalisation Principle to subjects with Special Educational Needs (SEN) implies that the educational system must introduce new teaching instruments to ease their integration. In the particular case of Spain, a 9% of the total population suffer some kind of disability [1].

In the University of Alicante, there are 237 students with a disability certificate; 22 with visual disability, 20 with hearing disability, 22 with mental disability and 58 with some kind of motor disorder [2]. The SEN of these students range from intensive and systematic instruction of basic abilities, learned by the rest of students in a natural and effortlessly way [3], to ease the access to the course information. It should be considered that both the teaching planning and action strategies in Special Education (SE) would imply to deal with students using specific technical aids during the teaching-learning process, as required by the European Higher Education Area (EHEA) framework.

It is then understood that the students learning not only depends on them but also on the degree the aids they receive are adapted to their personal competences to ease the teaching-learning process, on the support model according to their needs and on their disability degree. According to the World Health Organisation (WHO): "the educational systems must adopt approaches more focussed on the student, with changes on the studies planning, teaching methodology and materials, and assessment systems" [4].

### 1.2 Bibliography review

The Warnock report [5] about SE establish that a student has SEN when shows any learning problem throughout his Compulsory Education, requiring a more specific attention and educational resources. The concept of Learning Disability (LD) and the conceptual framework of the SE have widely changed since the first theoretical ideas, appeared in 1800, until now [6]. They have gone from a medical, welfare and segregating concept, which considerate the disability as an inherent, static and stable characteristic, to a new concept that could be defined as strictly educational. Regarding this, it is considered that the most suitable definition for LD is that proposed by Rourke et al [6]: "Learning Disabilities are a generic term that refer to an heterogenic group of disorders that show up as significant difficulties controlling one or more of the next abilities: listen, speak, read, write, argue, mathematics or any other skill traditionally referred to as academic. A Learning Disability may be associated to other incapacitating conditions (i.e.: sensory disorders, mental retardation, social and emotional disorders) or influences. Nevertheless, it is possible that emotional disorders and other adaptive deficiencies may come from the same central processing deficiencies that create the social



and academic Learning Disabilities”.

With the aim to get over these LD, teachers should establish suitable strategies for curricular adaptation. They should face the challenge to design activities to assist those students with learning problems. In this sense, changes in the present teaching-learning methodologies are needed to achieve an inclusive education [7]. Though this objective includes a wide amount of activities, in this work we will focus on those related to the adaptation of technological resources to SEN students, with the aim to ease their teaching-learning process. The characteristics of these didactic resources are adjusted to the behaviour and communication disabilities, according to the principles of curricular adaptation established by the 1997 International Classification of Impairments, Disabilities, and Handicaps (ICIDH), which defines:

- Behaviour disabilities: those related to the subjects awareness and ability to behave, both in the daily activities and the relationship with others, including the learning ability.
- Communication disabilities: those related to the subject ability to generate and express messages, as much as receive and understand them [3]

The technological adaptation of the above mentioned resources is established depending on the individual characteristics of the student, as a function of the cognitive and behavioural approaches required to fulfil the adapted curricular objectives. This is in agreement with the Spanish CEAPAT (Centro Estatal de Autonomía Personal y Ayudas Técnicas: Personal Autonomy and Technical Assistance National Centre), that defines technological tools as “those products, instruments, equipments or systems derived from any kind of technology and intended for disabled and/or elder people, produced specifically for them or already available for any person, which prevent, compensate, relief or neutralise the disability and improve the personal autonomy and life quality”.

The teacher must adapt the technologies and prepare the materials needed for the “supporting teaching and learning”, handing it in later to the students whose characteristics require an specific “pedagogical help”, with the aim to bring them alternatives to their deficiencies, fulfilling them and using other sensorial channels [8, 9].

In 1998, Orkwis and McLane stated that for a Universal Design of Instruction (UDI) “publishers should prepare and teachers should select instructional materials that are supportive and inclusive of students who have wide disparities in their abilities to see, hear, speak, read, etc.” [10]. Regarding to the learning materials accessibility, as an example, their content should be perceived through different senses, any person should be able to use them, and they should be designed to work with both the current and the future technologies (including supportive technologies).

### 1.3 Objective

The objective of the present work is the adaptation of the educational materials, in the tailored curricular adaptations framework, using QR codes to introduce additional information to complement the teaching action with SEN people.

What gives the QR codes the category of technical tool or supporting tool for the students is in Vigotsky conceptual framework [11]. Introducing the QR codes in the educational materials make easier the methodological adaptations for SEN students, turning them into technological teaching tools in the service of the required supporting design.

In this work, a working line is implicitly suggested for teachers involved with SEN. Consistently, the role of the teacher, far from being reduced, will be widened as he is in charge to prepare and provide the students with the appropriate materials. Moreover, as the QR codes in teaching materials are related to different technological tools, and the authors know about the difficulty for people with disabilities to access to computers, we recommend an adequate orientation such as the ALBOR method provides, which is deliberately aimed at people with disabilities looking for computer access solutions.

## 2. Methodology

### 2.1 Context and participant's description

The methodological approach for the QR codes implementation in teaching materials has already started in different subjects of several Sciences Faculty Degrees at the University of Alicante. Specifically, it has been applied to the next subjects (in parenthesis are named the Degree and academic year): “Chemistry of the Solid State” (Materials Science Master – year 2011-2012) and “Fibres and Composites” (Chemical Enginery Degree – year 2013-2014). The students who tried this new methodology signed on these subjects in the respective years. In spite of none of them exhibit an explicit SEN, the study was made with them to find out their opinion about how these new teaching



materials with QR codes incorporated may help in the learning-teaching process to students with some kind of deficiency.

## 2.2 Materials and tools

To develop this work, it has been necessary: i) a QR codes generator (free downloadable from the web; the program “QR encoder” is among the most useful for its easy and intuitive use); ii) a computer program to incorporate the generated QR codes into the teaching materials (usually the same program used to generate the teaching documents, i.e. word, power point, etc.); and iii) a QR codes decoder (also available for free download from the web for any current mobile dispositive, such as smart mobile phones or tablets with a camera).

## 2.3 Methods

Since none of the students who tried this new methodology showed any kind of explicit SEN, as a curricular adaptation, different teaching materials were prepared with QR codes implemented in different ways for every student or group of students. The differentiation was made on the basis of a written survey (done at the beginning of the course), which questions dealt with their main learning problems and the better way for them to learn and work on the “Materials Science” concepts (which is the conceptual framework of the analysed subjects). Some students asked for teaching materials with a bigger visual content, while others asked for a wider offer of alternative reading list, different from the usual texts. Also, not few of them explained their wish to have examples and solved problems as the subject’s lesson evolves, to support the concepts they are learning.

On the basis of these results, teaching materials with incorporated QR codes were prepared, in accordance with the curricular adaptations the students demanded according to their learning problems.

## 3. Results

With the incorporation of QR codes to teaching materials, they become interactive materials, allowing the necessary curricular adaptations to improve the students’ learning process and, indeed, the achievement of their objectives. Moreover, the easiness to generate QR codes has permitted to perform individual adaptations, regarding the different learning problems. In this sense, the ICT cover the specific needs of every student following the next variables: favouring the attention, favouring the memory, as mediation strategies between the student and his learning and, finally, spreading and invigorating the learning.

In general, the incorporation of an ICT tool, such as the QR codes, brings many possibilities to improve the teaching materials. To complete the study developed in the present work, at the end of the course the students filled in a survey, in order to show their satisfaction degree after their experience with the teaching materials containing tailored QR codes. All the students, without exception, viewed very favourably the experience. All of them argued that it had, undoubtedly, deeply helped them in their teaching-learning process. Moreover, they argued that QR codes are a dynamic and dynamising tool, and they should be used in every subject. Finally, the students were really grateful to the teachers for their work adapting the teaching materials to their specific needs.

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