ICT Resources for Educational Purposes

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This chapter presents a typology of Information and Communication Technology (ICT) resources for educational purposes. Some techno-pedagogical models are analyzed, offering a framework to implement the ICT resources in educational contexts. The TPCK model [see website for TPCK] focuses on the importance of knowledge (K-knowledge) in content (C-content), Pedagogy (P-pedagogy) and Technology (T-technology) and the possible relationships among them. We also describe the learning styles and polyphase activities model (EAAP: Estilos de Aprendizaje y Actividades Polifásicas), in which learning activities can be designed by considering different combinations of learning styles. A classification of ICT resources is presented in three main areas: information resources (e.g., webgraphy and online databases), collaboration resources (e.g., blogs and wikis) and learning resources (e.g., webquest, repositories of educational resources, podcasts and m-learning). A proposal for teaching and learning with ICT resources is developed in a conceptual map to illustrate how to these resources should be integrated for specific objectives.

Keywords ICT; Information and Communication Technologies; Educational Resources; Taxonomy; Information Resources; Collaboration Resources; Learning Resources; web 2.0; mobile learning.

1. Introduction

A teaching aid can be defined as [1] "any action that the teacher planned to use in the design or development of the curriculum (by you or the student) to approximate the content or facilitate, mediate learning experiences” (p. 186). Traditional teaching aids can arrange training through information resources (e.g., literature and encyclopedias), collaboration tools (e.g., discussions and seminars) and learning resources (e.g., tutorials and textbooks).

Instructional media design requires [2] "a rearrangement of the traditional and the integration of digital, ..., extending the design of media in the network and direct use.” (p. 199).

The term information and communication technology (ICT) encompasses the advanced technologies for information processing and communication (see website for wikipedia_ICT) designed to encourage information and communication processes. ICT for teaching facilitates the creation of multimedia content, collaborative environments and e-learning scenarios.

ICT applied to the training process can be divided into information resources (e.g., Webgraphy and online databases), collaboration resources (e.g., mailing lists and blogs) and learning resources (e.g., repositories of educational resources and podcasts).

The use of teaching resources is required to illustrate the construction model, integrate data into the design process and ensure the adequacy of the presentation of instructional content by programming teaching units [3]. Marquès [4] notes that educational media includes the following functions:

- To motivate, arouse and maintain interest.
- Provide information.
- Guide student learning: organizing information, linking knowledge, creating new knowledge and applying it.
- Assess knowledge and skills.
- Provide simulations that provide environments for observation, exploration and experimentation.
- Provide environments for expression and creation.

Spiegel [5] lists the following functions of teaching resources (pp. 34-35):

- Translating content into different languages.
- Providing organized information.
- Facilitating practices and drills.

2. Instructional Design Process

The phases of instructional design involve the specification of various key elements, such as learning competencies, content, methodology, activities, resources and evaluation (Figure 1).
The proper design of each of these elements is a key aspect of the teaching-learning process:

- **Learning competencies.** Delineate learning outcomes in terms of general and specific skills involved in training.
- **Content.** Develop content in both traditional formats (e.g., guides and texts) and digital formats (e.g., platforms and forums) and incorporate instantiations of the conceptual, procedural and attitudinal required for the application of knowledge to real contexts.
- **Methodology.** Select teaching strategies that involve the active participation and creativity of the students throughout the learning process.
- **Activities.** Create a variety of activities and tasks to strengthen the content and its application in various situations.
- **Resources.** ICT resources contribute to the inquiry process for students to meet high level educational objectives. The site provides individual (e.g., websites) and collaborative (e.g., virtual campus, blogs) workspaces to work on content and activities.
- **Evaluation.** Mechanisms for the diagnosis, monitoring and certification of competencies should be implemented. The ePortfolio provides a continuous evaluation strategy by collecting information about achievements and reflecting on them.

3. ICT Educational Resources for Information, Collaboration and Learning

ICT educational resources can be analyzed according to their use as resources for information, for collaboration and for learning, although in practice we will find educational hybrid configurations (Figure 2).

3.1 ICT Information Resources

ICT resources provide additional information to address a topic from basic to advanced levels. As noted by Medina [2] (p. 199), we are facing a new scenario which offers ample flexibility and availability of data sources and direct access to web resources.

ICT and information resources can provide updated data in different media formats. Some ICT Information Resources will include the following: Webgraphy, virtual encyclopedias, online databases, web 2.0 tools (e.g., social bookmarks, YouTube and Slideshare) and visual search engines based on web 3.0 (semantic web) features (Figure 3).
Webgraphy offers full-text documents available on the web (e.g., articles from ejournals and ebooks). Webgraphy documents include online journal articles, conference papers and conferences, documents produced by institutions, and eBooks.

Virtual encyclopedias allow detailed search of a topic. Some examples are Wikipedia [see website for wikipedia], Wikiversity [see website for Wikiversity], which focuses on the university sector, and Wikieducator [see website for WikiEducator], which is used for publishing educational materials.

These online databases are an essential information resource for researchers. They provide documentary references from different sources (e.g., journals, conference proceedings and government institutions), including, in some cases, the full text documents. One example of these databases is ERIC [see website for eric] in the educational field.

Web 2.0 tools enable the user to browse, create and share documents containing information on a subject through resources in various formats, including texts, videos, and graphic presentations. Some tools that facilitate this task are social bookmarks such as del.icio.us [see website for del.icio.us], video repositories such as YouTube [see website for youtube], and graphic presentations [see website for slideshare]. Social bookmarks allow the creation and sharing of resources indexed by labels or tags. Repositories allow the upload of videos or audio recordings on various topics. These repositories can be thematic videos, such a TeacherTube [see website for TeacherTube], where institutional audio-visual presentations, recordings of teachers, students' academic videos and teaching material support can be found. With graphic presentation spaces, slides prepared for presentations can be shared in different contexts (e.g., classroom, conferences and eTutorials).

Other resources of interest for research are visual search engines. Some examples are Thinkmap [see website for Thinkmap], Twine [see website for twine] or AuthorMapper [see website for authormapper]. These "semantic" search engines interrelate various fields of interest in a search (e.g., authors, institutions and articles) and present the results using an intuitive interface.

As noted by Echevarría [7], "No society has provided so many opportunities for information such as ours, but their volume is so great and access to it so varied, that the main difficulty is now to identify what information is needed, how to obtain it and how to harness it." (p. 286)

3.2 ICT Collaboration Resources

ICT resources for collaboration offer users the opportunity to participate in professional networks and co-create resources. Collaborative work allows the assessment of existing resources and their use in different contexts and then analyzes these resources to enable their creative use in collaborative learning contexts.

Some collaborative ICT resources are mailing lists, groups and collaborative web 2.0 tools such as wikis and blogs. Webinar is a widely used tool for organizing online seminars. (Figure 4).

Distribution lists allow the receipt of regular information through email about events, articles, links based on the theme of the lists to which the user has subscribed.

Collaborative groups offer a web space where those interested in a particular topic are able to reflect through thematic forums and share documents.
Wikis [see website for Wetpaint] and blogs [url: blogger] are two examples of web 2.0 tools that offer an intuitive way to create shared content web sites (wiki) and thoughts (blogs) on each subject area of interest.

Seminars on the web (Webinar) afford the opportunity to participate in real-time seminars on the network and to view them later offline.

Another resource for collaboration that has led the network is participation in social networks or in virtual worlds (Second Life) in virtual communities.

### 3.3 ICT Learning Resources

ICT resources for learning offer the possibility of acquiring knowledge, attitudes and procedures during the teaching process. ICT resources offer various forms of work with content and activities. An integrated design of learning resources is an important part of the instructional process that helps achieve the expected learning outcomes.

Some ICT learning resources are repositories of educational resources, interactive tutorials, online quizzes, web 2.0 tools (e.g., eBooks, podcasts) and open online courses (Figure 5).

Repositories of educational resources offer a variety of teaching materials created by educators, researchers, students, and others. These can be repositories of learning objects (e.g., Merlot and Agrega) composed of content units with activities and evaluation tests.

Interactive tutorials allow one to process guided presentations using text, graphics and audio. These resources can replace the closeness of face-to-face tutoring sessions in self-learning and virtual environments.

Online questionnaires as a learning resource can be used in diagnostic, monitoring and final evaluations of training sessions. The online format can also be used to determine anonymously the degree of satisfaction regarding a training activity [see website for Google Docs].

Some web 2.0 tools facilitate the use of educational electronic books (eBooks) or audio classes on the Internet [podcast] on the subject that is being addressed, enabling users to create their own productions.

OCW (Open Course Ware), a source of online courses, offers content resources that have been used in classroom. This type of course is consistent with the OER (Open Educational Resources) initiative to provide freely available educational resources on the Web through Creative Common licenses [see website for creative commons], a resource for authors wishing to protect their intellectual property.

### 4. Theoretical Models of Integration of ICT in Education

We selected two theoretical models that we consider of interest in the integration of ICT in educational contexts: TPCK and EAAP.

#### 4.1 TPCK Model

The TPCK model [see website for TPCK] focuses on the importance of knowledge (K) in Content (C), Pedagogy (P) and Technology (T) and the possible relationships between them (Figure 6).
This model allows us to incorporate resources among different types of knowledge involved in the design of digital educational resources: content, pedagogy and technology.

- Some exemplifications are presented integrating the model during the design process of resources to improve the presentation of content, such as graphic editors, publishers and multimedia (TK-technological knowledge).
- Tools to facilitate reflection on learning can be blogs or social forums (PK-pedagogical knowledge).
- Resources for further knowledge of the subject area can be online databases and online encyclopedias (e.g., Wikipedia, WikiEducator) (CK-content knowledge).

The challenge lies in the ability to integrate knowledge of the three elements—technology, pedagogy and content knowledge (TPCK) [8]—according to the possibilities offered by each, depending on the variables in each educational setting.

4.2 EAAP Model

The learning styles and polyphase activities (EAAP, for the name in Spanish [Estilos de Aprendizaje y Actividades Polifásicas]) model offers a variety of approaches to the design of digital resources according to different types of activities selected in relation the styles promoted: single-phase (1 style), two-phase (2 styles), three-phase (3 styles) and eclectic (4 styles) [9] (Figure 7).

We present some examples of the potential of the model to integrate resources for the development of activities according to each configuration:

- Resources to promote priority style (single phase), such as thematic search engines and online databases, to reinforce the active style.
- Resources to reinforce two styles together (two-phase), such as forum or working groups online to strengthen the reflective style and to share different contributions.
- Resources to promote three styles (three phase), such as modalities of ePortfolio for reflection, learning and assessment.
Resources for all styles (eclectic), such as tools for editing and creating web content (e.g., wiki and shared whiteboard) that allow editing and content sharing to promote the design, implementation and evaluation of resources that make the development of the cycle of learning correspond to the four styles: active, reflective, theoretical and pragmatic.

Taking into account the possibilities offered by various types of digital resources, we can carry out selections by taking into account various techno-pedagogy models.

5. Proposals of Teaching-Learning with ICT Resources

Teachers should integrate ICT resources to take advantage of this favorable environment in which students are digital natives. We describe the idea that teachers who develop their subjects in Virtual Campus can create conceptual-epistemological frameworks for her subject, in which the group can learn within a structured set of educational resources [10] (p. xii).

As a working proposal for the teacher, we present a conceptual map and taxonomy for the use of ICT resources. This map (Figure 8) joins various ICT resources and highlights a goal that is an example of a tool that makes teaching and learning possible.

![Teaching and Learning with ICT resources](image)

**Fig. 8** Teaching and Learning with ICT resources.

ICT resources can be useful at different times and for different purposes throughout the teaching-learning process. The following ICT resources have been selected to illustrate for what and how these resources and tools can be used: thesaurus, repositories, online encyclopedias and video recordings.

Another proposal of integration is the creation of taxonomies of ICT resources to enable its educational use in different scenarios, taking into consideration various elements such as resource type, learning styles, type of knowledge and tools (Table 1).

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<td>2</td>
<td>C</td>
<td>AuthorMapper</td>
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[1] Learning Style: Active (A), Reflexive (R), Theoretical (T) and Pragmatic (P)
[2] EAAP: 1 style (1), 2 styles (2), 3 styles (3) and 4 styles (4)
[3] Type of Knowledge: Pedagogy (P), Content (C), Technology (T)

Different ICT resources have been selected in this taxonomy: visual thesaurus, news, learning objects, audio recordings and video recordings. For each resource, its potential from different approaches is analyzed: learning styles,
type of knowledge and editing tools. One of the advantages for teachers and students is the simplicity of the web 2.0 tools that allow users to create information, collaborate and share learning resources.

6. Conclusions

The integrated design of content, activities, resources and assessment is shaping pedagogical proposals aimed at improving the learning process. Teachers need to acquire skills that allow integration of ICT resources from different approaches: information, collaboration and learning. This variety of ICT resources must be organized, adapted and applied for educational purposes.

The Educational Origami Blog [see website for educational origami] presents activities based on Bloom's Digital Taxonomy: remembering, understanding, applying, analyzing, evaluating and creating.

Several theoretical models have been presented and conceptual maps and taxonomies of ICT used in different contexts have been analyzed in the literature. The ICT resources based on web 2.0 represent a lifelong learning opportunity for teachers, students, administrators and all educational agents in the community. One of the new features that help in the dissemination and creation of resources in web 2.0 are mobile learning editors (see website for ubik), which offer more opportunities to learn anywhere and anytime (Brazuelo and Cachero, 2010) [11].

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