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## **APPLYING BIGGS CONSTRUCTIVE ALIGNMENTS TO ONLINE INTERDISCIPLINARY EDUCATION**

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### **Introduction**

Today's world is facing complex and dynamic challenges including climate change, sustainability, energy and public health. These challenges call for collaboration and complex solutions which are often demonstrated in interdisciplinary approaches (Lawson, 2010; NSF, 2006; NIH, 2004). More and more scientists are encouraged to work across disciplines (NSF, 2006).

Interdisciplinary education has been emphasized by many academic and scientific institutions, because of being facilitative to holistic understanding of complex situations, humans, contexts and issues, (CFIR, 2005; Holley, 2009; Fischer, Tobi & Ronteltap, 2011; Zarin, Kainer, Putz, Schmink & Jacobson, 2003). Especially in the field of health care, due to the complexity in health-related problems, interdisciplinary education has become a phenomenon since 1960s.

At the same time researchers and practitioners have become increasingly interested in the potential of online learning, as economic constraints leave fewer resources available for professional development (Friesen, 2009). Online technologies are developed to improve learning activities and professional development opportunities with the benefits of connectivity, flexibility and interactivity (Knight, 2004) between members with different perspectives and levels of expertise in a wide variety of contexts.

Facing with these actual challenges, our European FP7 training network, iCARE (improving Children's Auditory Rehabilitation) aims at providing interdisciplinary training for 16 junior researchers from different disciplines in 9 institutions in Europe, with the objective to create a new generation of researchers capable of working cross disciplines for the ultimate aim of improving the inclusion of children (4-12 years old) with hearing impairment (HI) in an oral society.

Communication through language is vital to develop and maintain everything around us. By 15 years of age, about 5 out of 1000 children suffer from a moderate, severe or profound HI that can potentially affect communication, learning, psychosocial development and academic

achievement if not handled appropriately. The EU promotes the active inclusion and full participation of disabled people in society. However, full active inclusion in an oral society can only be achieved through interdisciplinary involvements and collaboration between researchers with different approaches and expertise in different research fields and specializations (medicine, neurology, acoustics, psychology, audiology, engineering, speech therapy, special education, etc.).

Unique and challenging about the iCARE network is the wide training consortium that ranges from academia, industry and socio-economic agencies, while the 9 full partners and 7 associated partners are located in different countries in Europe. Training is provided in a blended mode, both face to face and on-line. Besides traditional training in local host institutes and a few occasions of face to face interdisciplinary training at winter schools and seminars, the researchers need to receive interdisciplinary education from different geographical locations. Online learning appears as the learning scenario which permits in iCARE to reach its main goal: providing an online interdisciplinary education training focusing on the auditory rehabilitation of children with hearing impairment.

Our current research aims at designing an interdisciplinary educational model to support iCARE interdisciplinary training. In this paper, we will first present the literature review of interdisciplinary education, then propose our online interdisciplinary model, and discuss the methodologies to evaluate the model including the limitations of the research.

## **Literature review: the landscape of interdisciplinary education**

Despite increasing publications on the developments and deliveries of interdisciplinary education programs in higher education, the understanding of interdisciplinary education is still limited and the challenges remain high, such as how the interdisciplinary training should be organized and facilitated (Hall & Weaver, 2001; Morse, Nielsen-Pincus, Force & Wulfhorst, 2007; Rhoten & Paker, 2004). The areas that draw more attention from researchers are the interdisciplinary educational model design, evaluation and methodologies.

With regard to interdisciplinary educational model design, there is not a widely accepted model yet. Critics of the educational model design rise from the following aspects: i) Lack of theoretical support from learning and psychological background (Cooper, Carlisle, Gibbs & Watkins, 2001); ii) Poor instructional design such as lack of assessment methods or constructive alignment (Biggs, 1996; Cooper et al., 2001; Thistlethwaite, 2012) and iii) Lack of information to guide designing interventions (Remington, Foulk & Williams, 2006).

Evaluation remains one of the least-understood factors, despite a large number of publications on interdisciplinary practice (Klein, 2008). Lattuca, Voigt and Fath (2004) suggested that besides the need to evaluate the effectiveness of interdisciplinarity, the evaluation of learning and teaching process are also needed. Many researchers (e.g. MacDonald, Walton & Sun, 2008; Thistlethwaite, 2012) stated that the development of valid, reliable and feasible assessment is a major challenge for interdisciplinary education.

As for the evidence of interdisciplinary education, students were found to benefit from interdisciplinary education through change of attitudes, beliefs, and knowledge, but fewer studies reported changes in behavioural level. And primarily short-term effects were represented (Cooper et al., 2001; Thistlethwaite, 2012). The methodologies of interdisciplinary education studies are often accused of being unrigged, such as: limited outcome measurement, little evidence from controlled trials, controlled before and after studies, and interrupted time series studies (Cooper et al., 2001; Thistlethwaite, 2012).

Although the challenges for interdisciplinary education are high, as Thistlethwaite (2012) stated, the interest to develop best practice models based on evidence of effectiveness in interdisciplinary education is increasing both in education and research. Learning from the lessons of previous studies, we designed the interdisciplinary education model for iCARE.

### **Conceptual framework: an interdisciplinary educational model in the context of iCARE**

#### ***Fundamentals of the interdisciplinary educational model design***

As the expected iCARE model requests integration of instructional design, interdisciplinary education and online learning, our design of the iCARE interdisciplinary educational model is based on: the instructional design framework ADDIE (Analysis-Design-Development-Implementation-Evaluation), the literature review on interdisciplinary education, and the potential of Biggs constructive alignment in interdisciplinary and online education.

The ADDIE model is commonly used for guiding instructional designs. The ADDIE concept is being applied in our research for incorporating fundamental elements of instructional design principles into a manageable process (Moellem, 2001), as well as for constructing performance-based learning. The analysis phase involves the investigation of learner, content, task, learning platform and the consequent influence on the design. We started with analysing the learning needs from the participants including learning styles, E-learning experience and expectations through surveys and interviews. The design phase addresses how instructional objectives shape strategies. The development phase addresses the creation of instructional materials, the learning environment and platform. The implementation phase addresses the educational interventions that executing the programs. The evaluation phase addresses both formative and summative assessment of iCARE interdisciplinary education.

Literature review in interdisciplinary education is scarce with generalized educational models because of the diversity of learning goals, learning activities, length of intervention and amounts of disciplines involved. Being aware of the critics on the model design in interdisciplinary education reviews, we try to build the model taking into account the drawbacks that were often reported in studies. For instance, the model design is underpinned by social constructivism because firstly it emphasizes how social encounters influence learners' meanings and understanding (Atherton, 2013), and it is often used in collaborative and interprofessional learning (Hean, Craddock & O'Halloran, 2009). Furthermore, the

model will provide toolkits, modules and process templates for instructors to easily develop other interdisciplinary interventions.

Biggs' 'Constructive alignment' (1996), turns out to be very instrumental for our iCARE interdisciplinary educational model, because of its multiple orientation. Constructive alignment combines both the constructivist learning theory and the instructional design. The curriculum objectives represented as "performances of understanding" are used to systematically align the teaching/learning activities which are judged to elicit those performances and the assessment of the performances. Being student-centred and outcome based, Biggs' Constructive alignment is influential in higher education. Furthermore, it has shown its influence not only in traditional disciplinary higher education, but also in interdisciplinary and online instructional design (e.g. Bennett et al. 2012, Borrego & Newswander, 2008; Slaouti, 2007). Because of the multiple orientations to learning theory, instructional design, interdisciplinary education, and online learning, Biggs constructive alignment appears to be a suitable framework for us to build our iCARE interdisciplinary education model.

Therefore, following the processing guidelines of ADDIE and guided by the literature review, we design the iCARE interdisciplinary model based on Biggs constructive alignment and adjusted it into online interdisciplinary learning context.

### ***Description of the iCARE interdisciplinary educational model***

The iCARE interdisciplinary educational model (Figure 1) is composed of four parts: learning needs analysis, curriculum objectives, teaching/learning activities and assessment tasks. The curriculum objectives functioning as the central part of the model, are used to systematically align the teaching/learning activities and the assessment tasks.

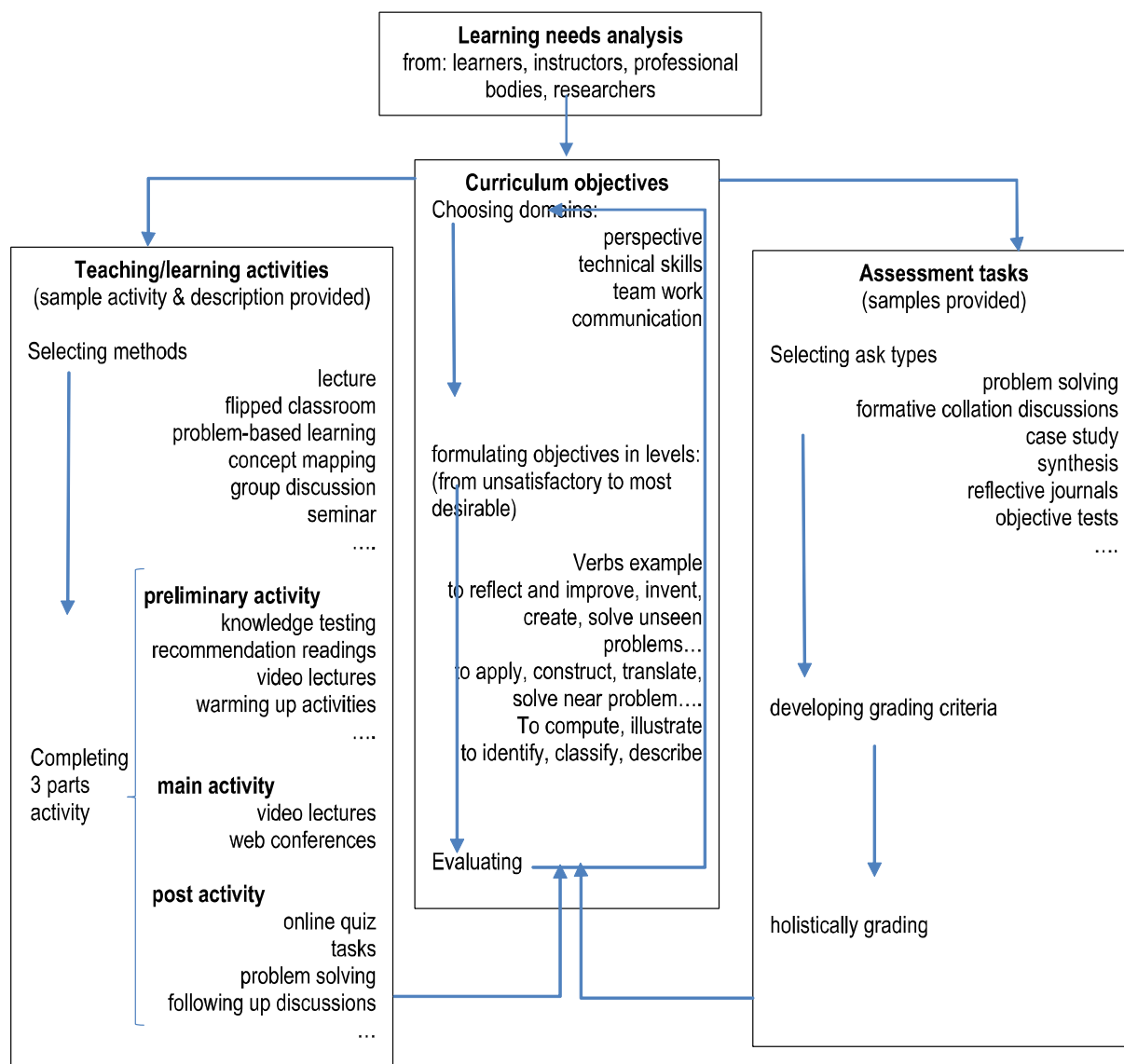


Figure 1. iCARE online interdisciplinary educational model

### *Analysis of learning needs*

Learning needs analysis forms the origin of curriculum objectives. Data from different parties including learners, instructors, professional bodies, and educational researchers are to be collected to define the curriculum objectives.

### *Curriculum objectives*

Constructive alignment starts with clearly stating, not what the teacher is going to teach, but what the learner is supposed to be able to do and at what standard (Biggs & Tang, 2007). Due to the complexity and the initiation of iCARE interdisciplinary education, the expected outcomes of learners need to be identified first. A four-step cycle is designed to accomplish the goal of defining the curriculum objectives: i) analysing learning needs; ii) deciding the domains of the desired interdisciplinary outcomes; iii) formulating objectives in levels, which is to complete the writing of “performances of understanding” in different levels including unsatisfactory, barely satisfactory, moderately satisfactory, very satisfactory and most

desirable. The objectives should be described in verbs that represent the levels of performance of understanding, iv) evaluating to adjust the result.

### *The teaching/learning activities*

The teaching/learning activities are designed to require students to apply, invent, generate new ideas, diagnose and solve problems (Biggs & Tang, 2007). Two steps are identified in the iCARE model to design teaching/learning activities. The first step is to select the appropriate learning method, and the second step is to complete the three parts activity design (pre, main and post).

Various teaching/learning methods are provided in the iCARE model, including lecture, flipped classroom, problem-based learning, concept mapping, seminar, group discussion, etc. Both teacher controlled and peer controlled activities are available in the choices. The provision of the methods is based on research in enhanced learning, blended learning and interdisciplinary learning.

Based on the studies of acquisition of intellectual skills and development of expertise (Van Lehn, 1996; Ericsson & Smith, 1991), as well as the fact that students engagement is often absent in online learning, the teaching/learning activities are designed in three parts: preliminary activity, main activity and post activity to enhance the online learning experience. According to different teaching/learning methods, various web-based technologies are used to support the teaching/learning activities. For example, the videos could be used for the main activity in a lecture, or for the preliminary activity in a flipped classroom, or for the post activity in a seminar.

The feedback of teaching/learning activities goes back to the curriculum objectives to make necessary adjustment.

### *The assessment tasks*

Three steps are listed to design the assessment tasks: selecting the assessment type, developing grading criteria of desired learning outcomes, and holistically grading.

The assessment tasks will tell not how well students have received knowledge, but how well they can use it, such as in solving problems, designing experiments, or communicating with different audiences (Biggs & Tang, 2007). Different types of assessment tasks are provided with examples in the model, including writing tasks, objective tests, various performance assessments such as case studies, problem solving, projects, etc.

In order to judge how well the desired learning outcomes have been met on the basis of the students' performance on various tasks and thereafter to provide information to students by the assessments, qualitatively and holistically assessment methods are used in the second and third steps.

The feedback of assessment tasks will go back to the curriculum objectives to make necessary adjustment.

## **Future directions**

The research aim is to further design, develop, implement and evaluate the iCARE interdisciplinary educational model. The model could be used for both PhD and Master students training, and will scaffold teachers in future interdisciplinary educational design. Our hypothesis is that iCARE partners perform better in (developing) interdisciplinary competencies when learning happens according to the iCARE interdisciplinary learning model. Experiments with control groups and analysis within and between groups will be conducted to testify our hypothesis. The fact that learners with different backgrounds have different requests for interdisciplinary training makes the measurement of experiment delicate.

The expected result is a testified educational model which can be used for online interdisciplinary learning in the field of auditory rehabilitation. At the time of the conference we hope to present some preliminary results of how the model is used in interdisciplinary learning (both face to face and on-line) by the iCARE community of researchers.

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