THE DESIGN OF AN E-LEARNING MODULE CENTERED IN THE USE OF AN INNOVATIVE WEB HEALTH APPLICATION FOR ATTENTION DEFICIT HYPERACTIVITY DISORDER MONITORING

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Abstract

Inscribed in the scope of an international partnership, this paper aims to describe the design of a learning module in ADHD, which intends to familiarize learners with the use of a Web Health Application created to carry out innovative ADHD interventions on educational and clinical settings. Developed for higher education students (psychology, medicine, education) and teachers/experts working with ADHD children, the design of this e-learning module is grounded in the triangulation of declarative, procedural and conditional knowledge - as conceived by Anderson [1]. For the integration of these three dimensions of knowledge, the module is organized into a 3-Step Learning Cycle, leading students to a first step focused in "knowing the condition of ADHD", a second one related to "knowing personal and environmental factors of a given situation" (i.e., the usage assessment approaches and strategies), and a third one dedicated to "knowing how to solve the problem" (i.e., the usage intervention approaches and strategies). The structure of each step is inspired in a Problem-Based Learning (PBL) methodology, having as starting point an authentic situation, from which students are challenged to define a strategy to approach child participation restrictions, finding in the Web App a supportive tool to develop assessment and intervention processes congruent with the state of art of knowledge. Operationalization of teaching and support strategies for the integration of declarative, procedural and conditional knowledge about ADHD assessment and intervention, are discussed in this paper in light of steering principles guiding the e-learning design.

Keywords: e-learning, ADHD, PBL, Web Applications; WHAAM project; ICT

1 INTRODUCTION

The Attention Deficit Hyperactivity Disorder (ADHD) is a neurobiological disorder which interfere significantly with child functioning in familiar, scholastic and social areas [2]. Its symptoms persist into adulthood with different symptomatology in almost 60% of the ADHD population. Given the presentation and challenges of ADHD change over time, clinicians must take a lifespan approach modifying their care and treatment according to the individual's current needs [3]. The Consensus statement [4] agrees that the most effective treatment of ADHD is the multimodal approach, which aims to combine behavioral interventions with parent/teachers training programs, alone or in combination with the use of medications.

Collaboration among parents, teachers, careers and health professionals is, in fact, essential in creating a wide social support network having the aim to reduce the seriousness of the symptoms and facilitates a good integration of the child in his own environment. Nevertheless, a great misinformation on this issue even now exists! Teachers, parents, and counsellors are generally unware that the characteristic hyperactive-impulsive and distracted behaviours of an ADHD are triggered from aversive environmental stimuli and maintained by multiple functions. Frequently, teachers and parents prefer to use physical interventions that tend to tackle the symptoms rather than understanding the disability and finding preventative ways around managing the difficulties.

In the light of these considerations, we think that for increasing awareness about the care process in ADHD needs comprehensive tools focused in monitoring child-environment interactions, useful to

disclose the purpose or function that a specific problematic behaviour serves. Literature show how the use of observation methods (functional behavioral analysis, ABC charts, daily report cards, etc.) play a significant part in understanding and modify the characteristics of a difficult situation. Observation can be considered as a bridge between the assessment and intervention phase [5] [6] [7].
To have an integrated view on this issues and to promote a change in the perspective of the care process of ADHD, this contribute want to refer to the project WHAAM (Web Health Apllication for ADHD Monitoring).
WHAAM is a project funded by the EU Lifelong Learning Programme (Measure KA3) involving five European countries: Italy, Portugal, Greece, Ireland, and the UK. The project objectives are:
- the creation of a shared theoretical Framework which collect the most recent research outcomes in ADHD assessment and intervention methodologies and strategic ways in which ICTs can support ADHD multimodal intervention [8];
- the development of a Web Application targeted at parents and teachers of students/children with ADHD, and health professionals, with the aim of promoting a network of people who can manage well-time monitoring of dysfunctional behaviors in the main life contexts: school and home;
- the design and delivery of a training course for teachers and parents of children with ADHD aimed at creating a network of caregivers familiar with behavioral modification techniques and the Web Application features;
- the development of an ADHD e-Learning module to construct a learning community engaged in studying and testing the methodological and technological approaches for supporting the inclusion of ADHD students in educational processes.
Throughout the above mentioned lines of action, a strong impact on the target groups of researches, educators, psychologists, teachers, parents and health professionals, interested in this topic, is expected.
This contribute will be focused mainly on last outcome showing a concrete methodology to familiarize learners with innovative ADHD interventions on educational and clinical settings.

1.1 Aims of the e-Learning module

As above mentioned, one of the main aims of the WHAAM project was to promote evidence-based practices (EBP) in context of the ADHD treatment, especially within naturalistic environments, as home and school. In this respect, in the European landscape one can note a lack of homogeneity and different levels of awareness. In some countries, for example in Italy, the ADHD is even now under-diagnosed, and schools and teachers are often not able to face these students. In other countries, a higher level of awareness around the ADHD does not match with an equivalent level in the development of training courses on evidence-based treatments, aimed in spreading a multimodal approach within schools and families.
In general, it possible to affirm that "*The principles of evidence-based medicine (EBM) provide clinicians with the ability to identify, source, appraise and integrate research evidence into medical decision making*" [9].
This statement often requires a real paradigm shift from the "traditional paradigm of authority in health care decision making" [10] towards "the integration and implementation of best available evidence with clinical expertise and patients' values and circumstances" [11].
To sustain the paradigm shift a learning module was designed, taking into account the following issues:

a) The peculiarity of the contents: not only guidelines and recommendations, but mainly skills and competences, in addition to a new habit in the therapeutic intervention, more as a researcher habit rather than an executor of instructions.
b) The scarcity of similar learning module in higher educational courses, both at graduate than postgraduate levels, in the countries of the project partnership. Consequently, the need to reach students allocated in different countries.
c) The demand to involve different competencies, students enrolled in medical courses, but also in psychology, science of education, nursing profession, etc. Therefore, the contents of the module must be able to adapt to different educational level, and centered on the EBP rather than theories and abstract concepts.

Considering these issues, the decision was to plan an e-learning module, to supply by using an e-learning platform, in which some common materials are given at all, but each professor will can personalize and extend, adding new contents, multimedia, and other resources. The use of an e-

learning platform permits also to design an effective interaction within the virtual classroom, using tools for the discussion and for the creation of shared documents.
This module, devoted to methodologies and technologies for monitoring and treatment of ADHD students, was conceived to help the construction of a learning community engaged in studying and testing the methodological and technological EBPs for supporting the inclusion of ADHD students in the educational processes.
The main target was students at level 7 of the EQF European Higher Education Area framework (Master and Postgraduate) interested to enhance their knowledge, skills and competences about the monitoring and treatment of ADHD pupils. The course will be addressed to:

a) higher education students enrolled in psychological, medical, pedagogical faculties;
b) teachers and/or experts working with ADHD students in order to improve their professional skills in a lifelong learning perspective.

The module will pertain the following matters:

a) state of the art of ADHD theories;
b) study of a multimodal approach for ADHD interventions;
c) use of the ICT. Based tools to carry out evidence-based ADHD interventions.

The organization of this master course is only a first step in the direction of the hoped paradigm shift. The next research questions to resolve concern:

a) How to design learning experiences able to support students in developing of the new competences and skills, required for an effective application of the EBPs [9].
b) How to describe these experiences [12].
c) How to evaluate those [13].

The study of the results of this module could be exploit also to give some answers to these very important research questions.

1.1.1 The WHAAM App

The WHAAM application (WA) aims at planning and supporting effective behavioural interventions in ADHD children. Inspired by the multimodal approach to ADHD (Arnold et al., 1997; MTA Cooperative Group, 2004), the WA has the ambition to promote a better communication between people who are relevant for the ADHD child in multiple life contexts such as family and school. In the WA, health professionals, teachers, and parents (or more in general relatives of the ADHD child) can share a common environment in which they can log the child undesired behaviour topographies and share general information about the child diagnoses, medications, and school discipline referrals. Moreover, the WA allow users to perform a so-called functional assessment defined by Horner (1994) as the use of “a set of strategies used to identify the antecedents and consequences that control the problem behaviour” so as to facilitate the definition of behavioural plans aimed to reduce undesired behaviours or to replace them with positive ones. Finally, the WA offers users a set of features to evaluate the effectiveness of the applied treatments. In fact, the WA calculates the Kendall (2011) TAU-U statistical index on the behavioural data gathered by the child network members. The TAU-U index is used to estimate the effect size of a treatment on the occurrences of an undesired child behaviour.
The WA is composed by a web application and a mobile app for iOS and Android operating systems [14]. The web application allows users to create networks, access the collected data, plan and evaluate behavioural interventions. The mobile application is specialized in data collection. In particular, it is used to gather behaviour occurrences and information about antecedents and consequences of a behaviour.
The WA applies encryption techniques to protect users personal data and implements authentication credential management procedures to restrict the access of users to only the information that have been granted to them.
The design of the WHAAM Application (WA) has generated many clever inventions, ideas, and creative intuitions to transform a very complex matter such as ADHD behaviour management into digital features.

2 E-LEARNING MODULE DESIGN

By intending to get learners involved in reflection processes focused in ADHD theories and multimodal approaches, this e-learning module aspires the development of a learning community engaged in studying and testing the methodological and technological approaches for supporting the inclusion of ADHD students in the educational processes. Pursuing that goal, a distinctive feature of this e-learning

module is the intention of immersing the learners in the praxis of ADHD assessment and intervention processes, presenting the WHAAM Web Application as an innovative and supportive tool in that processes.
Designed at level 7 of the EQF European Higher Education Area framework, this module is directed for higher education students (psychology, medicine, education) and teachers/experts working with ADHD children. The duration of this module is previewed for six-weeks, with an attendance per week of a mean of four hours. Although this term prediction, the module's content is available in all moments, allowing learners to progress in their own pace.
The online learning environment (OLE) used was the Moodle Learning System, which link for accessing the module will be shared and disseminate by the moment of the conference. Within that environment, the communication facilities include discussion forums, chat room, and e-mail for the exchange of ideas with peers and module tutor in the reflection processes instigated along the module. Aligned with the intention of stimulating self-directed learning - as described below (*vd*, module framework) -, module facilities include also an online library of relevant articles initially set up by the module tutors and incrementally developed by learners as additional resources are discovered by them and shared with their peers (**figure 1**).
A certificate of participation and of completion is given based on specific evaluation activities that students will undertake. The assessment for the module is twofold, embracing a component of self-evaluation, where learners are lead to upload activities at the end of each module step and to evaluate how well the goals were met; and a final evaluation embodying a case study which development are monitored and assessed by the module tutor. Two Universities directly connected with the partners countries involved in the project will conduct accreditation process of the module (2 ECTS).
Refinements and readjustments in the conception of the e-learning module, were made based on its analysis by experts (combining expertise areas of teaching methodologies and ADHD field of practices) and on its' piloting in a group of students.

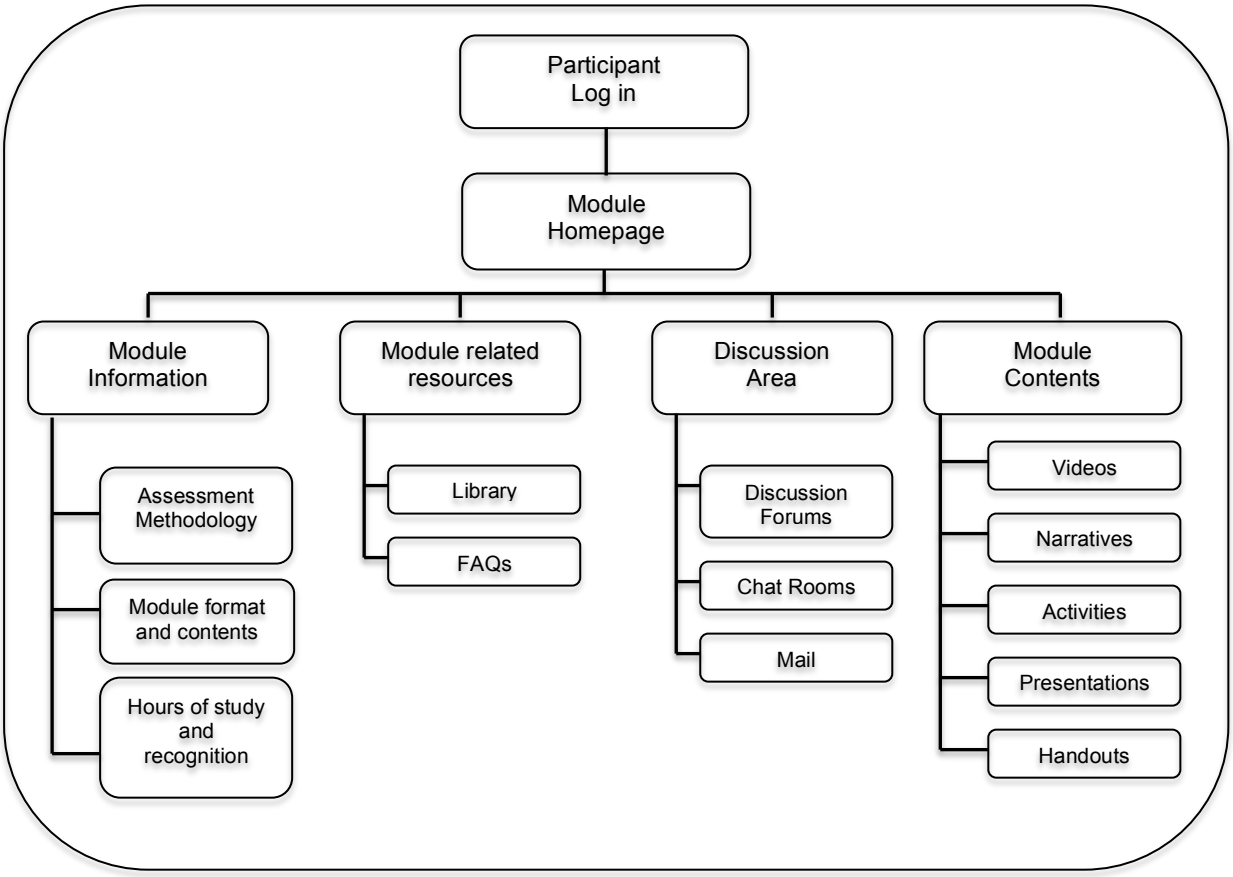

Figure 1. Schema of e-learning module

2.1. Framework of the E-Learning Module

The module design was conceived in order to provide learners with best available research/ information on ADHD, as well as opportunities to integrate and experience strategies - aligned with best practices – approaching ADHD related restrictions; recognizing WHAAM Web App as a supportive tool to conduct assessment and intervention processes. Stated at the conceptual and practical levels, the goals of this module seem to follow closely the understanding of knowledge taxonomy proposed by Lee Shulman [15]. This author defined the knowledge acquisition as a process resulting from the interaction between scientific knowledge and the structures of practitioners personal knowledge, including not only contents related with research and theories, but also, with a set of information obtained through practices. Aligned with this conception, Anderson [1] highlights that the acquisition of knowledge is architected on three main forms of knowledge, which content and application served as background for the conception of the e-learning module:

a. Conditional knowledge: referring to the application of knowledge in the context of case exemplars implying learners' awareness of when, where, and why knowledge should be used; *i.e*., applying the knowledge into problem solving processes relative to a concrete situation of a child with ADHD.

- In the module, learners are introduced to real-life situations - participation restrictions of a child with ADHD - presented through video and narrative sources representative of different perspectives about the problem. The real-life circumstances drives learners' attention to the themes explored in the module, introducing dilemmas/ problems to be addressed. Perspectives about the problem include the practitioners and families perspectives in order to convey the importance of considering their values and experiences as part of the problem solving process.

b. Procedural knowledge: relative to the learning of procedures, skills and abilities involved in the appliance of the knowledge in problem-solving processes; *i.e*., learning assessment and intervention procedures to approach participation restrictions of children with ADHD.

- The strategic knowledge are triggered through the engagement of students in different activities, challenging the development of problem solving processes relative to the presented authentic situation. The activities encompass, in the first step of the module, the identification and mapping of concepts and information that students consider they need to know in order to capture a full understanding of the presented situations. Activities embodying further steps in the module, challenges the implementation of problem-solving reasoning regarding the assessment and intervention planning based on presented cases/ situations.

- To support the knowledge appliance, demonstrations of the use of the WHAAM Web App - as a tool supporting behavioral assessment and intervention processes congruent with the state of art of knowledge -, are provided. Learners are engaged in a tour of the WHAAM Web App, revealing its' proprieties to determine patterns of child behavior based in a Functional Analysis Assessment and to define intervention strategies. Further in the module, based in provided data (related to the authentic situation) learners are challenged to use the Web App to identify targets behaviors for assessment, to explain the function of a problematic behavior and, based on that, to design behavioral intervention plans.

c. Declarative knowledge: composed of factual information regarding concepts and their interrelationship; *i.e*., understanding theories and approaches related to the ADHD.

- It's provided to learners the opportunity to explore, in a meaningful way – based on concrete cases/ authentic situations -, evidence sources that are systematized into short presentations and complementary readings focused in the understanding of ADHD condition and approaches related to ADHD assessment and intervention processes.

- For the organization of sources of evidence and best available research, it was assumed – as previously stated – the multimodal approaches (i.e., a combination of behavioral interventions, training programs for parents and teachers and, when necessary, pharmacological treatments) as the most effective practice to deal with ADHD problems.

The use of the evidence/ research as part of a continuous cycle of learning is a concluding step in the module process – implying the application of the knowledge into the problem solving process relative to the authentic situation; where learners are asked to complete and present activities assignments. **Table 1** summarizes the methodologies and sources/ strategies used in the conception of the e-learning module in order to integrate a triangulation of declarative, procedural and conditional knowledge.

Table 1. The framework of the e-learning module.

Types of knowledge	*E-learning design methodology*	*Sources/ Strategies*
Conditional Knowledge	*Authentic situations*	*Triggers* *- Videos representing participation restrictions of a child with ADHD* *- Narratives from parents and practitioners about child behavior*
Procedural Knowledge	*Activities challenging the development of problem solving processes based in the authentic situations*	- Activities driving students to identify which kind of information they need to know; and to apply that knowledge making use of the WHAAM Web App - Demonstration of the use of the WHAAM Web App as a tool supporting the pragmatization of the state of the art
Declarative Knowledge	*State of art of knowledge*	*Sources of Evidence* - short presentations, systematizing information about models and theories regarding ADHD readings - Complementary readings
Desired Output	*Integration of the knowledge presenting a product resulting from the problem solving process relative to the authentic situations*	- Discussion Forums - Upload and tutoring of Activities Assignments

2.2 Structure of the e-Learning module

Based on the framework previously described, the structure of the e-learning module reflects a reasoning flow underlying problem-solving processes related to ADHD restrictions (**figure 2**), being each of the presented steps grounded, by itself, in specific problem-solving processes relative to concrete cases, where learners are lead to explore main contents of each step.

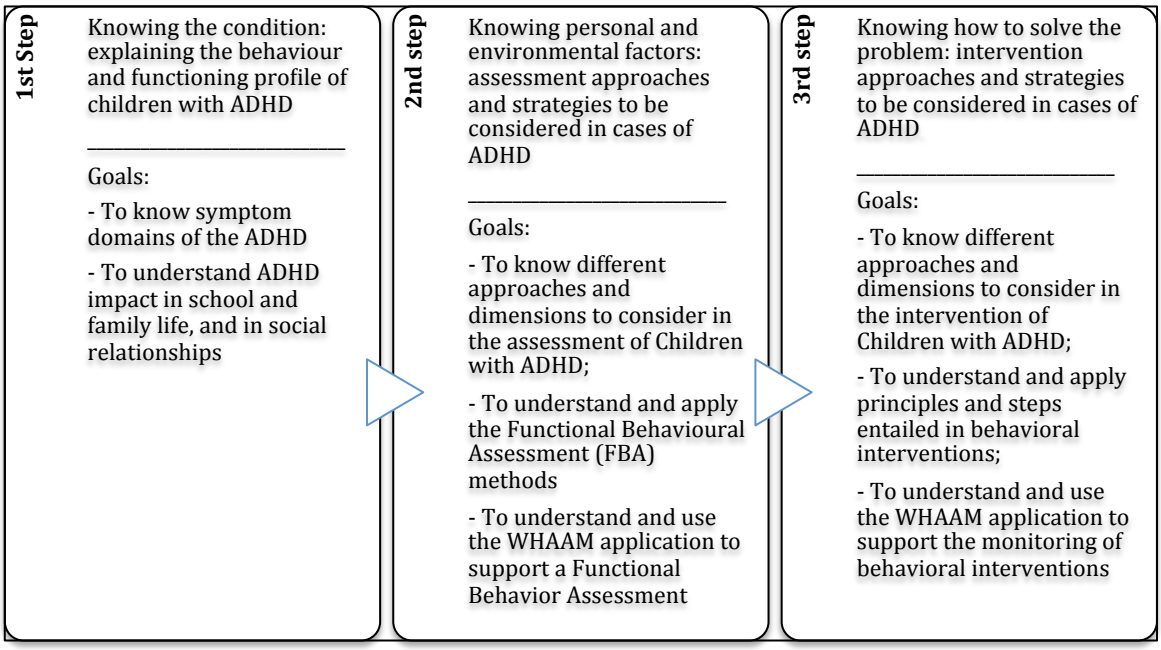

Figure 2. Steps of content released in the e-learning module

As such, each module step has as starting point a trigger, consisting in the presentation of real life circumstances that report participation restrictions of a child with ADHD from family members and practitioners perspectives. Following the active learning principle of learning by doing, learners are encouraged to begin a self-directed learning: raising questions and content areas that they need to know based in the presented real problem and in proposed activities. Learners are naturally driven into sources of evidence including the best available research, appraising its relevance to the unique context of the presented real life problem (e.g., characteristics of child, values of family, their own values and experiences).

Before engaging the student in the presented steps, the module starts with an introduction section, that, following same methodology, presents a real life situation from which is made a brief approach to the WHAAM Web App – considering its' use as a central feature mediating the experiences of assessment and intervention processes that are instigated along the module. Between the trigger and the short presentation of the WHAAM Web App, learners are confronted with an activity that question: "What should be known about child behaviour and functioning?" It leads learners to perceive the need of reflecting in issues like: the influence of different contexts on child's behaviours; of knowing how often, how long and where problematic behaviours occur; what motivates child behaviours; and what strategies should be used to manage child behaviour. The WHAAM App is, then, presented as a way – congruent with Functional Behavioural Assessment Methods - of: recording child's behaviours on varied contexts, using different sources (desktop and mobile devices connected to the internet); finding patterns of behaviours through the production of baseline charts; and planning and monitoring behavioural interventions by structuring ABCs analysis and allowing the comparison between baseline and intervention charts. A first tour on the use of the WHAAM Web App is, then, made, presenting its main functionalities and its coherence with the state of the art of knowledge.

1st Step: Knowing the condition

Based in a trigger – video and two narratives from a teacher and mother focused on child functioning - , learners are challenged to identify behaviours that might be representative of the criteria defining ADHD diagnosis and to describe how different are their expression across school and familiar contexts. Readings and a short presentation are provided focusing themes such as: symptom domains for ADHD according to DSM V; common associated developmental problems; epidemiology data and comorbid conditions; causes and risk factors; ADHD impact on school and family life, and on social relationships. Triggering learners to a successive questioning, forum discussions are centred on the sharing of ideas on how personal and environmental factors shape the functioning of children with ADHD – leading learners to reflect in key contextual variables influencing child behaviour and functioning.

2nd Step: Knowing personal and environmental factors

From a concrete case showing different life circumstances of a child with ADHD, learners are lead to a set of activities entailing challenges as: (i) identifying assessment targets and methods to capture a holistic understanding of child behavior; (ii) hypothesizing possible factors motivating / explaining the problematic behaviors; (iii) identifying the behavior function based on data presented by WHAAM Web App. Available contents (readings and short presentations) are focused on: the diagnostic process and the multidimensional functional assessment - examples of tools and target variables on Person, Environment and Person-Environment Interaction dimensions; functional assessment methods; and the use of the WHAAM app to support a Functional Behavior Assessment. The sharing of ideas on how different assessment methods can contribute for an integrated and holistic view of child's behavior, and how was perceived the WHAAM App utility to systematize observations and to find out the function of the behavior are prompted in forum discussions.

3trd Step: Knowing how to solve the problem

Based on data provided from a concrete case (embodying the trigger), the activities of this step challenge learners to: (i) describe problem behaviors and possible explanations; (ii) Identify possible replacement behaviors; and (iii) design a behavioral intervention plan. For do that, students are lead to explore best available research – through reading and short presentations – centered on: principles of a multimodal treatment; behavioral interventions: principles and steps; progresses monitoring; and the WHAAM app to support the planning and implementation of functional behavioral treatment protocols. Forum discussions instigated the share of ideas on factors contributing for a successful intervention towards children with ADHD; and on the utility found in the use of the WHAAM App for support the planning and implementation of behavioral intervention.

3 CONCLUSION

The framework adopted in the design of this e-learning module, is inscribed in a constructivist perspective of pedagogy, being inspired in different methodologies. A Problem-Based Learning (PBL) methodology is reflected in the module, concretely by trigger the learning process through concrete cases that lead the learners to a successive questioning and a self-directed study of contents and procedures they have to learn [16]. In this context, the usage of the acquired knowledge to solve problems within a specific context, meets our intention of building a bridge between declarative, procedural and conditional knowledge. Other main feature defining the design of the e-learning module, congruent also with the PBL methodology, is the instigation of a successive questioning. The module activities – leading learners to ask themselves what they need to learn - as well as the discussion forums will originate spaces for thought-provocative questions, actively engaging learners by asking questions of their own.

By combining research, innovation and practice – culminating through the presentation and use of the WHAAM Web App – it's our expectation that this e-learning module fosters a closeness to evidence-based practices by the learners (present and future practitioners), contributing this way for the enhancement of inclusion processes of children with ADHD.

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