Anaís: A Conceptual Framework for Blended Active Learning in Healthcare

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Abstract: The guarantee of the right to quality education is a fundamental principle for policy and management education. In addition to the organizational processes and regulation, as well as for citizenship, currently the student satisfaction plays a key role for the adequacy of actual courses and the needs of the educational community who depend on them. This way, interest on active methodologies has intensified with the emergence of new strategies that may favour the autonomy of students. Active Learning (AL) becomes an important strategy in healthcare to the extent that theory and practice go hand in hand in the training of health experts. This paper proposes a conceptual framework (Anaís) for active learning in healthcare studies and summarizes a qualitative research with healthcare experts and students on the feasibility and applicability of Anaís and its potentially positive results. Statistical tests and descriptive analysis of the collected data indicate Anaís could indeed bring a contribution to the healthcare area in terms of benefits to use it as an AL tool for professional training of physicians and other healthcare professionals and specialists.

1 INTRODUCTION

One of the great challenges of this new century is balancing development of individual autonomy in relation to that of the collective. Exploring innovative methods that admit a pedagogical and ethical practice at the same time that they offer critical, reflective and transformative instruction seems popular in the current context of education and university curricula. Such methods are expected to exceed the limits of purely technical training to create new challenges that motivate students. In this context, active methodologies studies have intensified with the emergence of new strategies that favour the autonomy of students, from those with the simplest requirements to those who need physical or technological readjustment of educational institutions (Farias et. al, 2015).

Active Learning (AL) instructional strategies include a wide range of activities that share the common element of involving students in doing things and thinking about the things they are doing (Bonwell and Eison, 1991). AL systems can be created and used to engage students in (a) thinking critically or creatively, (b) speaking with a partner, in a small group, or with the entire class, (c) expressing ideas through writing, (d) exploring personal attitudes and values, (e) giving and receiving feedback, and (f) reflecting upon the learning process (ElDin, 2014). These interactive-learning strategies offer students opportunities to connect new information to their own experiences, providing them with models for applying new knowledge, and promoting cognitive skills.

Numerous models or strategies for clinical teaching have been described in the medical education literature. Recently, the inseparability of theory and practice, the integral vision of man and the expansion of careful design have become essential for proper work performance (Souza, Iglesias and Pazin-Filho, 2014).

Day after day, specialist physicians carry out complex health analyses and must make decisions which might be fatal, in case they are erroneous. Santos, Moura and Araújo (2015) propose a conceptual framework (“Anaís”) for helping in the

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analysis and decision-making process of rare clinical cases. The framework is based on the association of medical evidence analysis techniques, knowledge management and collective intelligence in order to mitigate the risks and uncertainty faced by specialist physicians. Anaís could also be used as an educational tool, to help train health professionals. The educator can set up controlled cases and submit them to physicians being trained, so that they can give their opinions, in a simulated environment, building knowledge by means of interactions among the students. This paper brings results of a preliminary investigation on the potentiality and usefulness of using Anaís as an AL tool for professional training of specialist physicians.

2 RELATED WORK

The contents of this paper directly relate to Active and Blended Learning (BL) research efforts in higher education in general. Of particular interest are those works that consider audiences that need to build a knowledge expertise to make complex decisions such as in medical diagnosis (Dx) situations (with a computer-supported tool in special).

The work "Web 2.0 to Support the Active Learning Experience" showed a discussion of the active learning literature and the appropriateness of such strategies with net generation learners is provided (Williams and Chinn, 2009). The study also details the implementation of this experience within the curriculum, and assesses the benefits and challenges related to enhanced student learning and engagement as well as literacy outcomes. The authors observed that increased student engagement was noted in both instructor and student evaluations of the assignment.

Parmelee, DeStephen and Nicole (2009) showed a comparative study of how medical students' attitudes about the Team-Based Learning process changed between the first and second year of medical school with 180 students commenting on 19 statements regarding their attitudes about Team-Based Learning. The result demonstrated that students' attitudes about working within teams, their sense of professional development, and comfort and satisfaction with peer evaluation improve a curriculum using Team-Based Learning.

Cayley (2011) reviewed four specific clinical teaching strategies and the evidence for their impact on educational outcomes or office efficiency. Literature for this review was selected based on the results of a Pub Med search on the terms "medical student" and "precepting", review of references in retrieved articles, and the author's personal files. The research conclusion was that OMP and SNAPPS are strategies that can be used in office precepting to improve educational processes and outcomes, while pattern recognition and activated demonstration show promise but need further assessment.

Mitre et. al. (2008) aims to discuss the main methodological transformations in the education process of health professionals, with emphasis on active teaching-learning methodologies. Authors affirmed that the collective reflection, dialogue, recognition of context and new perspectives are the basis for the building of new avenues in the search for wholeness of body and mind, theory and practice, teaching and learning, reason and emotion, science and faith, competence and loveliness. Only through a reflective practice, critical and committed can promote independence, freedom, dialogue and confrontation of resistance and conflict.

Nilsson et. al. (2010) explored how clinical teaching is carried out in a clinical environment with medical students, looking for meaning patterns, similarities and differences in how clinical teachers manage clinical teaching; non-participant observations and informal interviews were conducted during a four month period 2004-2005. The findings showed that three superordinate qualitatively different ways of teaching could be identified that fit Ramsden's model (Ramsden, 1984).

Zaher and Ratnapalan (2012) had the objective of identifying the format, content, and effects of practice-based small group learning (PBSGL) programs involving Family Physicians. Authors affirm that there exist two main PBSGL formats (self-directed learning and specific problems from practice) and both formats are similar in their ultimate goal, equally important, and well accepted by learners and facilitators. Perceptions and learning outcomes indicate that PBSGL constitutes a feasible and effective method of professional development.

De Jong et. al. (2012) proposed three cases of blended, active and collaborative learning, using a virtual classroom, Second Life immersive virtual world and discussion forums, blogs and wikis. They wanted to know if blended learning can be active and collaborative and the results of the three cases clearly show that active, collaborative learning at a distance is possible.

Mubuuke, Louw and Schalkwyk (2016) proposed exploring students' experiences of

feedback delivery in a PBL tutorial and use this information to design a feasible facilitator feedback delivery guide. Individual interviews and focus group discussions were conducted with students who had an experience of the tutorial process in an exploratory qualitative study. The study has demonstrated that PBL facilitators need to provide comprehensive feedback on the knowledge construction process as well as give feedback on other non-cognitive skills outside the knowledge domain including effective communication, adherence to ground rules and maintenance of group dynamics.

The work "Developing an integrated framework of problem-based learning and coaching psychology for medical education: a participatory research" explored a new framework by integrating the essential features of PBL and coaching psychology applicable to the undergraduate medical education context (Wang et. al., 2016). Five themes emerged from the analysis: current experience of PBL curriculum; the roles of and relationships between tutors and students; student group dynamics; development of self-directed learning; and coaching in PBL facilitation. Authors anticipate that their investigations are useful in two ways. First, the Coaching + PBL Model could serve to stimulate consideration and debate as institutions develop their own PBL concepts and procedures. Second, their study provides insights into incorporating coaching skills into professional development programmes for PBL tutors and PBL curricula for students.

Blended Learning (BL) combines face-to-face and online learning to create variable sequence of knowledge acquisition and sharing (Bersin, 2004; Graham, 2006). BL experiments have since evolved to deal with richer blending options to produce "hybrid courses" and have become frequent in particular in many university and other higher education courses. (CSEDU, 2010-2014). In these hybrid courses or "flipped" classrooms, students engage in content learning before classes in order to maximize in-class time for active learning. In-class active learning helps produce significant learning as learners practice with, engage with, and apply pre-class learning. Although experimentation with Blended Learning (BL) is on the rise in all fields of education, the work of Drysdale et al., (2013) indicates that much of it is carried out at the university level as it is the case here with our target audience of medicine students. The works considered in (Drysdale et al., (2013) – over 200 graduate dissertations and theses on BL – relate to this paper in the sense that in one way or another they investigate the benefit of BL-programs over traditional face-to-face programs.

Subjective outcomes such as learning effectiveness, cost effectiveness, institutional commitment, student satisfaction, faculty satisfaction, etc. were described (Moore, 2005). (Arano-Ocuaman, 2010) noted that students preferred BL classes compared to traditional classes in the following areas: "(a) accessibility and availability of course materials; (b) use of web-based or electronic tools for communication and collaboration; (c) assessment and evaluation; and (d) student learning experiences with real-life applications". Similar results were found by (Barros et al., 2015) for an innovative approach that brings together BL and gamification strategies to a learning process.

All these approaches suggest that, besides the computer-based and blended learning approaches, there is an important role played by the instructor and students in the learning group or organization: the role of a knowledge manager that conducts and-or experiments a tacit-to-explicit-to-tacit knowledge conversion cycle as preconized by Nonaka and Takeuchi in their knowledge spiral model (Nonaka and Takeuchi, 1999). This cycle is made up of four modes of knowledge conversion: socialization (tacit to tacit), externalization (tacit to explicit), combination (explicit to explicit) and internalization (explicit to tacit). Accordingly, before analyzing the performance of a specific BL approach, such as that in Anaís, against face-to-face or other learning strategies for our target audience, it seems appropriate to evaluate the acceptance of the approach by the instructor as a facilitator to create and validate different blended learning options to a specific domain course. In this paper, we do that for Anaís for the case of healthcare studies.

To do this we use Anaís to compose an innovative BL environment for education in a healthcare learning context, highlighting the knowledge management sub-processes. This enables the combination of tacit-to-explicit-to-tacit knowledge conversion cycle in routine activities of a healthcare specialist (e.g. Anamnesis process, Lab tests) to computational techniques. The combination thus helps the exchange of experiences amongst participants of a healthcare team and the support of the collective learning process.

3 ANAÍS CONCEPTUAL FRAMEWORK

The Anaís Conceptual Framework comprises five macro stages as illustrated in Figure 1, namely: a) Anamnesis Process; b) Knowledge Management; c) Decision Strategy; d) Application of Procedures and e) Learned Lessons.

Each stage presented in the framework comprises a set of pooled techniques which receives, sequentially, the outputs of the previous stages. The specialist physician in charge of the analysis of the case is responsible for the Anamnesis, Knowledge Management and Application of Procedures stages. The Decision Strategy stage makes use of the Delphi method in an attempt to achieve convergence of the opinions of experts in the decision-making process. The end of the process is the generation of a new case, which is stored on the Learned Lessons database (Santos, Moura and Araújo, 2015).

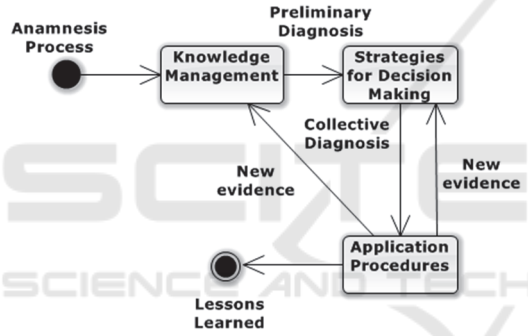

Figure 1: Anaís Conceptual Framework.

To produce the main learning outcome (diagnosis decision making ability) the hybrid learning concept supported by ANAÍS is created by the movement between the three spaces of the apprentice experience combined with the formal "spiral" based process of knowledge conversion. This combination blends 3 learning concepts: a) syncronous and assyncronous computer suported online learning experience helped by knowledge repositories and interactive research processes, b) active attitude of build knowledge supported by responsible relationships with coleagues, instructor and patients, and c) cognitive development produced in conventional classroom and-or clinical laboratory activities.

4 METHODOLOGY

This research is classified as an applied and qualitative research. It aims to get the opinion of a group of health experts and students (the target audience of the research) on the feasibility and applicability of the proposed Anaís framework as a support tool to blended active problem based learning (BAL).

We selected 60 persons using a random method selection, 30 experts who work in Brazil's Northeast (in the state of Paraíba) as health professionals, academics and researchers and 30 students of medicine. In the experiment process, we used the Think Aloud Protocol (Think Aloud, 2016) to ensure that all the participants understood the framework. The reason to select students and experts in health is analysing two different expertise and if the both thinks the same form about the solution.

We wanted to know whether experts and students of medicine believe that the Anaís conceptual framework can be used as an AL tool for professional training of specialist physicians. For this, we developed an Anaís Conceptual Framework to Active Learning based system. All the participants used this system and gave their opinions about it. They answered a questionnaire where possible responses were in the form of a 4-level Likert based scale: Strongly disagree = 0; Disagree = 1; Agree = 2; and, Strongly agree = 3. The sentences presented to them were:

A. I believe that the Anaís conceptual framework can be used as an AL tool for professional training of specialist physicians.
B. I am satisfied with the Anaís conceptual framework based system for active learning and could identify many effective contributions for the healthcare area.
C. I consider the model useful and I would invest (time, specification effort, testing, etc.) in its evolution.

5 ANAÍS BASED HYBRID BLENDED ACTIVE LEARNING

The main learning outcome of the Anaís blended active learning approach is the capability to produce a diagnosis of a case study. Problem enunciation (case) is proposed by the instructor and problem analysis (case study) by the students who offer their solution (diagnosis) with the possible assistance of the instructor and invited professional experts on the

healthcare case.

Activities are carried out by each group of students in three spaces: i) the physical space of the classroom used for intra- and inter-group, lecturer-mediated communications, including face-to-face classes and oral exams; ii) a virtual space in the Web ("Anaís BAL") that serves to synchronize and support learning activities, including mandatory Web lessons; to register discussion contents of the groups; to filter initial diagnosis proposals; to research information produced by groups in previous cases (and saved in the Anaís BAL repository); research of data available in the linked medical databases as PubMed – www.ncbi.nlm.nih.gov/pubmed/; and, iii) the real-world surroundings of the students´ living spaces. Students move between spaces as they are exposed to a sequence of situations during the case study period defined by the instructor.

The learning process is composed of 5 steps during which, students: i) receive from the instructor a case to study. The student leader of a group conducts the study; ii) go through their living spaces to carry out an anamneses while entering of data into the web tool; iii) build collective intelligence by converting knowledge using a Nonaka and Takeuchi spiral to produce preliminary diagnoses; iv) make decisions and produce a collective, convergent diagnosis from the preliminary diagnoses; v) register the results of case study in the Learned Lessons database.

Initially, only cases for cardiology and ophthalmology domains were considered (Fig 4). Convergence was facilitated by a Delphi method (Hsu and Sandford, 2007). Anaís BAL support for the Nonaka and Takeuchi knowledge management model spiral is as follows.

Socialization (tacit-to-tacit) – Anaís allows the instructor, experts and students to share tacit knowledge through observation, imitation, practice, and participation in the groups and in the formal and informal communities created around the 3 spaces of Anaís BAL environnement. **Externalization (tacit-to-explicit)** is supported by making instructor, experts and students articulate tacit knowledge into explicit concepts. Since tacit knowledge is highly internalized, this process is the key to knowledge sharing and creation to develop the collective intelligence. **Combination** (explicit-to-explicit) is an Anaís process by which students integrate different registered knowledge used to create their preliminary diagnoses and the final collective diagnosis into a new knowledge system, represented here by a new case registered in the Learned Lessons repository -that becomes a new tool of knowledge creation. Finally, **Internalization** is achieved by embodying explicit knowledge into tacit knowledge, by researching and reading the internal and external sources of registered offered by Anaís BAL repositories.

The software platform for Anaís BAL was developed using the Visual Studio 2012 with Microsoft ASP.NET MVC 4, Entity Framework 4 and SQL Server 2008 Express, Apache Solr 5.1.0 (text indexing), SolrNet, GoldenTrack 2009 (http://lightbase.com.br/tag/goldentrack/),GoldenAccess 1.2.4 (authentication system), PubMed API for .NET, Twitter Bootstrap (UI framework – http://getbootstrap.com/2.3.2/).

The authentication form is represented in Figure 2. All the system is Web based and the users must have been added to GoldenAccess System previously. There are two users' types: the first is instructor (with administrator powers) and the second user type is student. The instructor can add news cases for analysis by selecting (small) groups of students to learn and to interact on each study case in the collective intelligence phase (Figure 3).

The instructor plays the role of mediator in the construction of collective knowledge. He or she selects all cases to be studied by the groups of students and monitors all stages throughout the process. The student leader has the specialist function responsible for the case study. She or he will examine the case of information submitted by the instructor and will be the first to submit an

Figure 2: Authentication form.

Figure 3: News cases for analysis.

assessment of the case study. For this, one could use sources of external expertise (e.g. PubMed) and internal (based on lessons learned). The other students will participate in the collective intelligence step and will have the role of assistant experts, sharing knowledge and discussing the solution to the case study.

The anamnesis form is represented in Figure 4. The student leader will add all the patient information into the system using anamnesis processes. The anamnesis form is adapts according to each specialty. Here, we implemented the anamnesis forms for cardiology and ophthalmology.

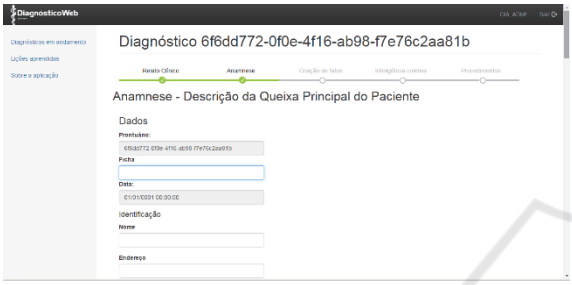

Figure 4: News cases for analysis.

Figure 5 presents a form to help tacit-to-explicit (externalization) and explicit-to-tacit (internalization) knowledge conversion. In this step, the student leader user will add all the evidences (laboratory tests, related papers, images etc.) about the case study. The user can also look for paper in the PubMed and in the Learned Lessons databases, appended to the case study.

At the end of this stage, a student group may present a preliminary diagnosis for the case study, which will be submitted to the analysis of other students participating in the learning process.

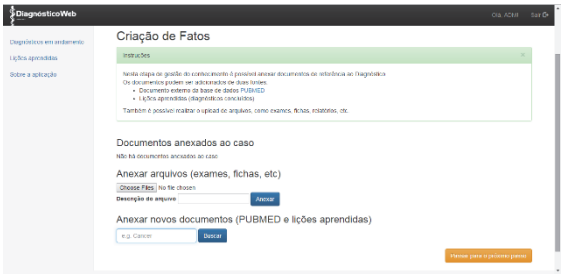

Figure 5: Tacit-to-Explicit knowledge conversion forms.

In the Decision Strategy step, helped by the forms illustrated in Figure 6, for each study case, all student groups share knowledge about the case being studied through collective intelligence. This phase is similar to a web forum, but convergence of all answers is facilitated by the Delph Methodology (Hsu and Sandford, 2007). When answer convergence is attained, a collective diagnosis is said to have been reached. The student leader will then produce new evidences or create a new protocol for saving in the Learned Lessons database (Figure 7).

Figure 6: Decision Strategy forms.

Figure 7: Learned Lessons database.

6 RESULTS AND DISCUSSIONS

This section offers statistics, graphics and discussions on the research results for the statements A, B and C of section 4.

We used an ordinal scale that is non-parametric and independent of the answers to questions A, B and C. We used the Mann-Whitney test, with confidence level 95% and alternative no equal. The results are shown in Table 1.

Table 1: Mann-Whitney test results.

Questions	Median	Mann-Whitney (U)
A	4 (Equals)	0,6627
B	4 (Equals)	1,0000
C	4 (Equals)	0,4965

We wanted to know whether experts and students of medicine believes that the Anaís conceptual framework can be used as an AL tool for professional training of specialist physicians. The Mann-Whitney tests showed that alternative

hypotheses were refused (results should be approximately the same). This shows that specialists and students have the same positive opinion about Anaís.

The results of the experiment in graphical form are shown in Figures 8, 9 and 10.

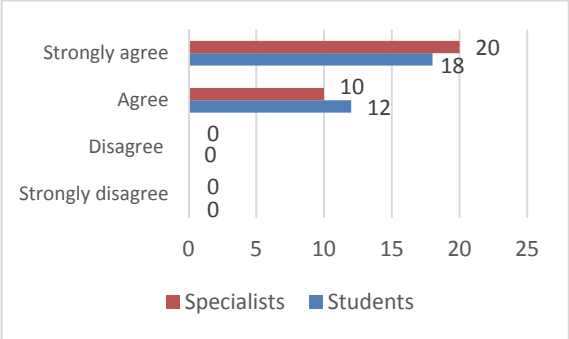

Figure 8: Question A answers.

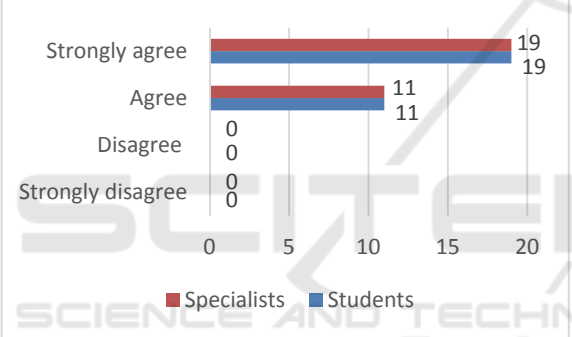

Figure 9: Question B answers.

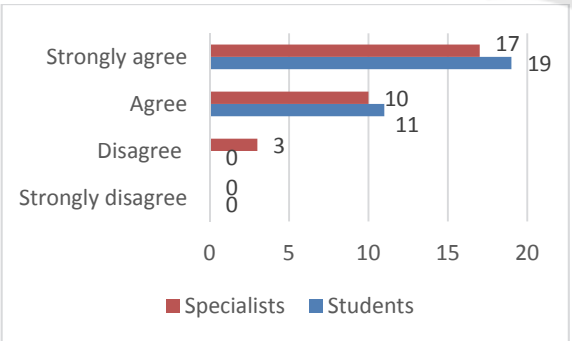

Figure 10: Question C answers.

From Figure 8, "strongly agree" with statement A is 63.34% (18 students and 20 specialists) while 33.66% "agree" (12 students and 10 specialists) - we can thus say that 100% of the respondents agree that the Anaís conceptual framework can be used as an AL tool for professional training of specialist physicians.

Equivalent conclusion can be drawn from the graph in Figure 9 concerning statement B: 100% of the users are satisfied with the Anaís conceptual framework and could identify many effective contributions to healthcare (63.34% - corresponding to 19 students and 19 specialists who strongly agree, and 33.66% - 11 students and 11 specialists who agree with the statement).

Figure 10 shows that 60% (19 students and 17 specialists) strongly agree, 21% agree and 15% (3 specialists) disagree with statement C when they ponder whether the model is useful and would invest in its evolution. We believe that these answers are biased by the time spent by specialists in equivalent research. Sometimes specialists have their own research on equivalent topics and students are more interested in completing subject requirements quickly.

Results from statistical tests, and also with the descriptive data analysis, indicate that, in the opinion of the specialists and the students, Anaís offers a contribution to the area of healthcare studies and it will bring benefits to learning as a BAL tool for professional training of specialist physicians.

7 CONCLUSIONS

Anaís was proposed originally (Santos, Moura and Araújo, 2015) to apply knowledge management principles of tacit-to-explicit-to-tacit knowledge in learning experiences. This research reported in this paper aimed at eliciting opinions of specialists and students in the healthcare area regarding the Anaís conceptual framework as an effective BAL tool for professional training of specialist physicians.

For that, 60 persons (30 health professionals and 30 students of medicine) were interviewed. They used the Anaís conceptual framework based system in a blended active learning scenario, and answered a questionnaire to assess whether they thought the proposed framework was valid BAL tool for professional training of physicians. Preliminary validation results are promising.

As for future work, we will concentrate on further evaluating the BAL tool and on studying of other cases with more specialists and students for extended validations.

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