A Situation-aware e-Learning System to support Intercultural Competence Development

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Abstract

Intercultural competence is a set of cognitive, behavioral, and affective skills that are critical for effective and appropriate communication and collaboration with people of different cultures. To effectively work in multicultural groups, and develop intercultural competence, a student must be aware of his/her cultural values and those of each member of the group, understand the cultural differences and decide the best course of action for communicating and collaborating with others, by achieving and maintaining adequate levels of cultural situation awareness. In this paper, we propose a conceptual architecture of a situation-aware adaptive e-learning system to support the work of multicultural student groups, fostering the development of intercultural competence.

Keywords

Situation Awareness, Fuzzy Cognitive Map, Cultural Situation Awareness, Learning Management System

1. Introduction

In the global economy, all sectors are required to operate in multicultural environments, whether in dealing with clients or within their own workforces. To prepare the future workers that will operate in such environments, learning courses should focus on developing the intercultural competence of the students. Intercultural competence enables students to interact both effectively and in a way that is acceptable to others when taking part in a group whose members have different cultural backgrounds [1, 2, 3]. Due to globalization, and thanks to many specific programs for student exchange, and thanks to online learning courses that can be easily accessible by students from all over the world, classrooms are always more international, with students coming from different cultures [4, 5]. Although both educators and employers agree on the high value of intercultural competence, as well as most higher education institutions consider these skills as important outcomes for their graduates, only a few have specifically addressed the means by which such competencies may develop [6]. Students, as well as educators, involved in multicultural classrooms and groups, need support to understand the cultural differences and how to deal with them, to develop their intercultural intelligence. In this paper, we envision an extension of our situation-aware Adaptive e-Learning System [7, 8, 9] to support cultural situation awareness of the students and their intercultural competencies.

2. Cultural Situation Awareness

Situation awareness (SA) is the capability of humans to understand what is happening in the surrounding environment with respect to the specific goals they are pursuing. More formally, SA has been defined by Endsley as the perception of the elements in the environment within a volume of time and space (SA Level 1), the comprehension of their meaning (SA Level 2) and the projection of their status in the near future (SA Level 3) [10]. The SA is influenced by many individual and cognitive factors like goals, experience, training, ability, preconceptions. All these factors are in part determined by the cultural aspects. Indeed, culture involves what people think, what they do, and the products (material and immaterial) they produce [11]. Culture influences members of society by shaping their values, perceptions, and behaviors [12]. Cultural Situation Awareness (CSA) is defined as an integral component of the human's overall SA, related to the cultural factors which comprehend the set of shared values, beliefs, attitudes, norms characterizing a specific group of people [13]. For many tasks and, in particular, for tasks performed by a multicultural group of people (as in some military operations, business meetings, international research activities, etc.), the understanding of the cultural aspects of the people involved is fundamental for the success of the tasks and for the achievement of the goal.

Several works studied the impact of the presence of students from different cultures in a course and the effect of cross-cultural teaching [12, 14, 15]. In particular,

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according to [16], underestimating the culture's role in e-Learning may lead to misunderstanding learners' reactions to different kinds of stimuli, which could lead to an error of adaptation to the learners' needs. On the other hand, the composition of multicultural groups of students could improve the cultural intelligence of each group member. But, in such contexts, it is important that each student is aware of the cultural differences of her mates, and that she knows how to interact with the others students. When performing activities with students coming from different culture, each student needs suggestions and feedback to understand and learn how to interact with others and develop their capabilities of CSA.

Specifically, in the context of online and blended learning, having a good level of CSA for students in the context of multicultural groups, requires: i) at SA Level 1, the perception of cultural cues, human behavior's aspects, and cultural facts and events; ii) at SA Level 2, the complex sociocultural relationships between individuals and the impact these could have on the learning processes and learning objectives should be identified; iii) at SA Level 3, the possible actions and modalities that should be considered to interact with the other students according to the intercultural situation of the group [9].

3. An Adaptive e-Learning System for Intercultural Situation Awareness

An Adaptive e-Learning system based on the SA paradigm and designed using the Goal-directed Task Analysis (GDTA) approach [17] has been proposed in our previous works [7, 8, 9]. This system is able to recognize the situations involving the students by analyzing the activities they perform. The recognized situation, together with the goal of the student, is used to adapt the learning course in terms of learning contents, learning objectives, but also to adapt the interface and the overall user experience. Feedbacks are sent to both students and teachers to guide their activities according to the current situation and their active goals. In this work, we propose an extension of such system to support and improve the level of cultural situation awareness and the acquisition of intercultural competencies of students working in multicultural groups.

Let's consider a typical scenario involving the proposed system. A multicultural group of students is performing a team project. Each student of the group interacts with the other members through the platform, enjoying also the available didactic materials (lectures, slides, articles, video, etc.), to complete the assigned learning activities and achieve the learning objectives. The learning

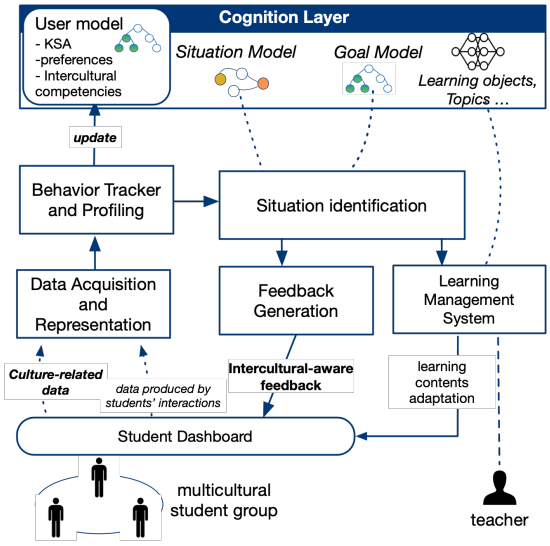

Figure 1: Situation-aware adaptive e-learning system supporting multicultural student groups

system provides social and collaborative features, like chat, instant messaging, blog, videoconferencing, forum, etc, to ease the communication and collaboration within the group, fostering the development of soft skills. The group has a common learning goal, which requires the completion of a series of tasks, and the production of some outcomes (e.g., reports, essays, presentations, etc.).

The conceptual architecture of the Adaptive Learning System is sketched in Fig. 1. The architecture has been developed following the design principles of situation awareness [17]. The architecture was organized into tiered subsystems, of which the most important ones are: i) Data Acquisition and Representation; ii) User Model; iii) Learning Management system; iv) Feedback Generation v) Behavior Tracker and User Profiling; vi) Situation Identification; vii) Student Dashboard.

The learning system maintains an updated user model for each student. The user model contains: the usual information about the user (personal information, account, preferences, sentiments [18]); the learning path, which contains information on the courses, learning activities, objectives the user should complete or has already completed; and a model of the competencies of the user.

The competencies are modeled according Knowledge-Skill-Attitude (KSA) model [19, 20], implemented using SKOS [1]. There are two main parts in the proposed KSA model, depicted in Fig. 2. The first represents the competencies related to the learning activities and objectives; the second represents the intercultural competence. The second part, representing intercultural competence, has

[1] http://www.w3.org/TR/skos-reference/

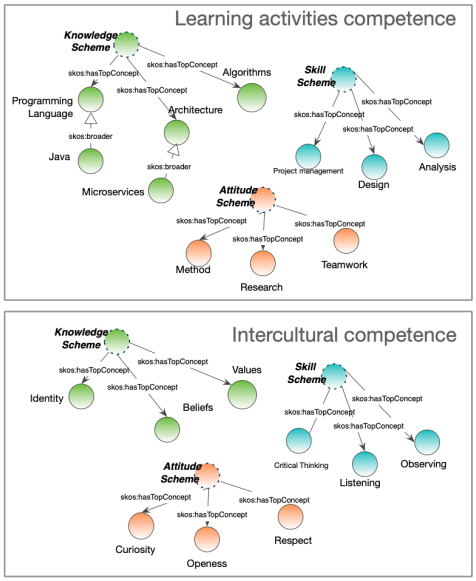

Figure 2: KSA model of learning activities and intercultural competencies.

been defined on the basis of the models proposed in [21, 22]. Knowledge necessary for intercultural competence included awareness of own culture (how our culture influences our understanding of the world); sociolinguistic awareness; elements of the culture of the others [2]. Skills include observation, listening, critical thinking, observing. Intercultural attitudes include curiosity and openness, discovery, respect, readiness to suspend disbelief about other cultures, and belief about one's own.

The module Behavior Tracker and User Profiling analyzes the activities of the students to assess their competencies, their level of proficiency according to the learning objectives, and to understand their profiles. In literature, complex techniques based on deep learning have been proposed to identify the profile of the users analyzing their interactions with a system [23]. The module is also responsible for identifying the level of intercultural competence owned by the students. Such competencies can be assessed using different tools and questionnaires. A review of intercultural competence assessment methods is proposed in [6]. By proposing a questionnaire at the beginning of the learning activities, the system measures the baseline intercultural competencies of each member of the student group. These cultural competencies are stored in the User Model. During the group work, the students will execute the task (assigned by the teacher or automatically by the learning system according to the learning objectives) and they will develop their intercultural competencies and develop the capabilities needed to build and maintain the CSA. At the end of the activity, a new questionnaire will measure the improvements obtained by each student for each KSA. Specific questionnaires can be used to measure also the level of SA [24]. This assessment will also provide interesting information to teacher and learner content creators to adapt and improve their courses, as to make them more effective in terms of intercultural competence awareness and development.

Another fundamental module of the system is the feedback generation module. This module uses Fuzzy Cognitive Maps (FCM) as described in our previous works [8, 7, 25, 9]. The maps are used to identify the situation involving the student and the whole group. According to this situation and considering the learning goal of the group, the system sends appropriate feedback to each student to improve the current situation, helping her in achieving the goal, and in particular, to develop intercultural competence. Feedback consists of suggestions, additional learning materials that should be studied, exercises, multimedia contents, topics, and ideas on which to develop a conversation with the other students, etc.

In the context of the intercultural e-learning system, in particular, the FCM aims at evaluating the cultural characteristics of each student of the group. This includes the evaluation of the cultural competencies and the intercultural intelligence owned by the student The module evaluates differences and similarities between cultural competencies and intercultural aspects of each student of the group. On the basis of the differences between the students, and considering the learning activities they are developing, the objective they have to achieve (e.g., improve the awareness of the other cultures, improve the sociolinguistic competencies, etc.), the learning path will be adapted (by the Learning Management Module) to foster the development of CSA and intercultural competencies. During the execution of the learning activities, the system continuously monitors the situation of every single student and those of the whole group. In case of a significant deviation between a current state and the learning objective, the system will send feedback to the students (using the FCM). In particular, the system will guide the conversations and the common activities between the students, remembering the cultural peculiarities and differences, and the suggested appropriate actions, to develop their CSA.

4. Illustrative example

Let's consider the following scenario to show how the system works in a real case. This scenario will also be used

[2] https://welcomm-europe.eu/intercultural-awareness/interculturality/

in future works for an experimentation carried out in the context of an elective university course called Cross Cultural Management (Data Science & Innovation Management Master Degree at the University of Salerno, Italy). Considering that the course is chosen by students is already in itself information about their expected high level of motivation to learn from other cultures or in any case to be part of a multicultural context. The course aims to provide students with an endowment of knowledge related to the analysis of cultural variables, as well as economic and social, that have an impact on individual and organizational behavior. It also aims to develop skills necessary for understanding the problems of interaction between different cultures within an organization or between organizations of different nationalities, for managing global teams (innovative, virtual, face to face). This course places greater emphasis on the human skills required to deal with the diversity inherent in global teams. Overall, it aims to develop the students' Cultural Intelligence (CQ) defined as an individual's capability to function and manage effectively in culturally diverse settings [26]. The student, at the end of the course, will acquire the theoretical knowledge and practical skills on problem-solving approaches, and the ability to use the main tools devoted to the resolution of specific problems deriving from cultural differences.

This course involves students from different countries and with very different cultures (for example, Central Europe, Eastern Europe, India). During the course, students are divided into groups of up to 4 people. The group is defined by the teacher so that it has students from different countries and, possibly, from different sociocultural clusters in accordance with the GLOBE project [27], for example, one Italian and one Spanish belonging to the Latin Europe cluster, a Russian belonging to the Eastern Europe cluster, an Indian from the Southern Asia cluster. At the beginning of the course, using the e-learning system proposed in the article, a survey is administered for the assessment of each person's cultural skills to allow students to be profiled. The survey is composed of 31 Items. Eleven items are used to gather background data about the students with respect to: the socio-demographic status (4 items), the past and present study experiences (4 items), the general abroad experience (2 items), and future plans regarding job or study activities (1 item). The remaining 20 items are used to measure the CQ of the students via the Cultural Intelligence Scale (CQS), a self-report scale developed by Early and Ang [26].

During the course, students will carry out various tasks and group work such as Country Case Studies (which includes specific steps to be done according to the theoretical knowledge provided by the teacher) and Role-Playing Games for which they use the collaboration tools of the proposed e-learning system. During these tasks, the system is able to send feedback and suggestions to students, using the Fuzzy Cognitive Map, encouraging collaboration and communication within the group. At the end of the course activities, further surveys (like the previous ones) will be administered. This will allow to measure the improvement of competencies and to update the student's profile. The evaluation will be aimed both at measuring the improvement of students' abilities - and specifically the CQ - and at providing feedback on the composition of the groups, and on the adequacy of the concept map used.

5. Conclusion

In this work, a conceptual architecture of a situation-aware adaptive e-learning system to support the development of intercultural competence and the collaborative work of multicultural student groups has been proposed. The system is based on the situation-awareness paradigm and, in particular, it supports the cultural situation awareness of the students. In future work, the approach will be evaluated in real-world scenarios in university courses, as detailed in the illustrative example provided.

References

[1] E. Prechtl, A. D. Lund, Intercultural competence and assessment: perspectives from the inca project, in: H. Kotthoff, H. Spencer-Oatey (Eds.), Handbook of Intercultural Communication, De Gruyter Mouton, 2008, pp. 467–490.

[2] M. G. Salazar, M. F. Agüero, Intercultural competence in teaching: Defining the intercultural profile of student teachers, Bellaterra Journal of Teaching & Learning Language & Literature 9 (2016) 41–58.

[3] B. Piana, M. Monteleone, The term "Global" in cross-cultural studies: A concordance analysis, Transcultural Marketing for Incremental and Radical Innovation (2013) 166–208.

[4] H. Mpirirwe, D. P. Mirembe, J. Lubega, J. E. Agaba, E-learning platforms and security mechanisms used by educational institutions in Kampala, Uganda, International Journal of Information Technology, Communications and Convergence 4 (2021) 47–62.

[5] K. Kalegele, School dropout profiling and prediction approach using machine learning, International Journal of Information Technology, Communications and Convergence 3 (2020) 245–258.

[6] M. R. Lombardi, Assessing intercultural competence: A review., NCSSSMST Journal 16 (2010) 15–17.

[7] G. D'Aniello, M. De Falco, M. Gaeta, M. Lepore, A situation-aware learning system based on fuzzy cognitive maps to increase learner motivation and

engagement, in: IEEE International Conference on Fuzzy Systems, 2020.
[8] G. D'Aniello, M. De Falco, M. Gaeta, M. Lepore, Feedback generation using Fuzzy Cognitive Maps to reduce dropout in situation-aware e-learning systems, in: 2020 IEEE Int. Conf. on Cognitive and Computational Aspects of Situation Management, 2020, pp. 195–199.
[9] G. D'Aniello, M. Gaeta, Cultural situation awareness in e-learning systems, in: CEUR Workshop Proceedings, volume 2903, 2021.
[10] M. R. Endsley, Toward a theory of situation awareness in dynamic systems, Human factors 37 (1995) 32–64.
[11] J. H. Bodley, Cultural anthropology: Tribes, states, and the global system, Rowman Altamira, 2011.
[12] A. Al-Hunaiyyan, A.-S. Salah, N. Al-Huwail, Blended e-learning design: Discussion of cultural issues, International Journal of Cyber Society and Education 1 (2008) 17–32.
[13] E. Onal, M. R. Endsley, Requirements and design for better cultural situation awareness: Delivering the right information, Proceedings of the Human Factors and Ergonomics Society Annual Meeting 56 (2012) 228–232.
[14] E. Blanchard, C. Frasson, Cross-cultural adaptation of e-learning, in: Handbook of Research on Instructional Systems and Technology, 2008, pp. 829–841.
[15] A. Edmundson, Globalized e-learning cultural challenges, IGI Global, 2006.
[16] E. G. Blanchard, C. Frasson, Making intelligent tutoring systems culturally aware: The use of hofstede's cultural dimensions, in: Int. Conference on Artificial Intelligence, 2005, pp. 644–649.
[17] M. R. Endsley, Designing for Situation Awareness: An Approach to User-Centered Design, 2nd ed., CRC Press, Inc., USA, 2011.
[18] G. D'Aniello, M. Gaeta, I. La Rocca, KnowMIS-ABSA: an overview and a reference model for applications of sentiment analysis and aspect-based sentiment analysis, Artificial Intelligence Review (2022).
[19] S. Miranda, F. Orciuoli, V. Loia, D. Sampson, An ontology-based model for competence management, Data & Knowledge Engineering 107 (2017) 51–66.
[20] G. D'Aniello, M. Gaeta, M. Lepore, M. Perone, Knowledge-driven fuzzy consensus model for team formation, Expert Systems with Applications 184 (2021).
[21] S. McKinnon, What is Intercultural Competence, Technical Report, Global Perspectives Project, Glasgow Caledonian University LEAD, 2018.
[22] W. Leeds-Hurwitz, Intercultural Competences: Conceptual and Operational Framework, Technical Report, UNESCO Digital Library, 2013. URL: https://unesdoc.unesco.org/ark:/48223/pf0000219768.
[23] G. Sansonetti, F. Gasparetti, G. D'Aniello, A. Micarelli, Unreliable users detection in social media: Deep learning techniques for automatic detection, IEEE Access 8 (2020) 213154–213167.
[24] G. D'Aniello, M. Gaeta, F. Orciuoli, G. Sansonetti, F. Sorgente, Knowledge-based smart city service system, Electronics (Switzerland) 9 (2020) 1–22.
[25] M. Chang, G. D'Aniello, M. Gaeta, F. Orciuoli, D. Sampson, C. Simonelli, Building ontology-driven tutoring models for intelligent tutoring systems using data mining, IEEE Access 8 (2020) 48151–48162.
[26] P. C. Earley, S. Ang, Cultural intelligence: Individual interactions across cultures, Stanford University Press, 2003.
[27] W. B. Gudykunst, Cultural variability in communication: An introduction, Communication Research 24 (1997) 327–348.