Robots Facilitate Team Building at Adults' Learning Groups for Cultural Studies

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***Abstract*—This paper examines if robotic activities can offer a proper context for adults' team-building and also proper learning environment. Effective team-building seems to be an important factor for adults' learning communities, but also for organisations' operation.**

Socially assistive robotics (SAR) related researches show that human-robot social interaction rather than physical contact, is the success key of many tasks from rehabilitation therapies to cognitive activities.

In our project, adults who met each other for first time, participated in robotics hands-on tasks in cultural studies. Tasks involved construction, but also social interaction with humanoid robots. Project implementation and data analysis showed that participants considered that robot involvement had a positive impact in both major goals: participants' team development and cultural aspect learning. Questionnaire analysis showed that the combination of such a technology with cultural activities can offer a context not only suitable for learning, but also for team-building. Social interaction with robots motivated participants to achieve progress in learning and to communicate/collaborate as a team.

***Index Terms*—Cultural studies, Educational Robotics, Team Building, Socially Assistive Robots, Interactive Robots, Learning Environment, Traditional Dance, Edutainment.**

I. Introduction

The last decades governments around the world have declare the need for more effective training for adults and have linked this objective specifically to the needs of the labour market. European Union member countries, agree that lifelong learning is one of the most important characteristics of social and working life not only in the future, but also in our days. Employees and professionals, of all skill levels, have to improve their technical and business skills and enhance them in order to be aware of the continuous technological changes and new job requirements [4]. The dramatic growth of the adult-student population and also the need to promote lifelong learning, stresses for proper organized educational methods, based on adulthood characteristics.

In the field of adult education, there is a long discussion about adulthood definition. According to Rogers [16], it is rather difficult to define an adult and identify those characteristics inherent within the cultural construct of adulthood. He suggests that the basic characteristics of adulthood include far-sightedness, self-control, established and acceptable values, security, experience and autonomy. Jarvis [7] adds that the concept of adulthood refers to those individuals who are considered as adults within their society.

Adults have different study approach from kids, with high ability of learning and also acquiring knowledge and skills. According to Courau [2], there are specific principles related to adults' learn, skills and attitudes acquisition. The first principle suggests that adults learn when they are familiar with the training material. With respect to the second principle, training should be related to adults' every day life, goals and needs with meaningful instructions. The trainer should inform them analytically for the educational goals and also their progress. Adults learn better if they can self-direct their training and also participate actively. They have accumulated a wealth of information and experience, which can function as a rich resource for learning. Major principle related to adult education is motivation to learn. Adult learners are primary motivated to internal factors, such as self-esteem, quality of life and job satisfaction. They need to feel that they belong to a learning group, with warm relations. The members of the group should accept and support each other and work cooperatively.

II. Team Building for Adults Learning

A. Theories and schemes

According to Courau [2], group activities facilitate adult learners to fulfil the most of the above mentioned principles. Team building also works as an organizational strategy to engage employees and improve productivity [11]. Researches [8], [13] show that team building has a positive moderate effect across cognitive, affective, process, and performance outcomes. Future work places may require people to rely on team members for rewards, recognition, and training traditionally provided by the company. Strong teams may hinge on developing career paths and designing career development events that are deployed through team-based experiences [1].

In team building, the adults form small groups (3-5 persons) and a project is assigned to them, which they have to accomplish in a certain period. The adults, as members of a team, have the opportunity to work together in order to solve a problem, or to work in parallel the different tasks of the same project. Because of the small group, they feel comfortable to express their opinion, to their teammates. In this way, team working, benefits the development of friendly and close relations between members and also increases participants'

self-directed learning ability Courau [2]. The intensive and authentic communication between team members, supports reflecting thinking, increases motivation to learn and secures active and critical participation in a social context [20].

According to Maslow's Hierarchy of Needs (1954), each member in the team seeks for safety (including freedom from anxiety and stress), the need for belongingness, friendship and love and also seeks to feel competent, confident and self-assured. These can be obtained easier, if the team starts its life cycle working on an achievable activity with edutainment characteristics. The original research about team-development model [18] describes four stages in the development of a team-forming, storming, norming and performing. The act of passing through the team-development process is the process of converting a loose group into an effective team. In the first stage (forming) the members are still unsure of each other and looking for the trainer's help. In the second stage (storming) members challenge the views of others and express their own, finding areas of disagreement. In the third stage members agree on the principles of cooperation and work together. In the forth stage, as the team reaches the end of their cooperation, either the members make one concerted effort to finish the project, or they are breaking up as they regret the end of the project. Later researches modelled team's life cycle in a more detailed approach [18], assigning key factors to the four stages.

The first two stages are considered crucial, since the team members try to adapt and relate to each other and also to find their role in the team. For this reason special effort is given by educators and consultants, but also by companies that sell infrastructure for team building. Lego Foundation has developed a special product range: Lego Serious Play, for facilitating the first two stages of team building: "It is a language, communication tool, problem solving methodology, based on the belief that everyone can contribute to the discussion, the decisions, and the outcome." [11]. The product (kit and instructions) propose three steps: Constructing, Giving meaning and Making the story.

B. Implementing Robots to facilitate the team building stages

The Human-Robot Interaction (HRI) for socially assistive robotics applications (SAR) is a relatively new established research area at the intersection of a number of fields, including robotics, medicine, psychology, cognitive sciences and sociology [21]. New applications for robots in health and education are being developed for broad population of users. In SAR applications the robot's goal is to create close and effective interaction with a human user for the purpose of giving assistance and achieving measurable progress in convalescence, rehabilitation, learning, etc [6].

Lego's Serious Play effort, which is based mainly on Constructionism theory [16] and Social Constructive theory, take advantages of the diversity of Lego's bricks and the unlimited creations that can be constructed. In the other hand virtual teams can be supported with special designed systems [7] or through computer games [3]. Robotics can offer both the construction and software capabilities in order to support diverse activities during team building. They also offer the opportunity to design and construct creations/mechanisms that have close relation with the team goals and the whole effort (adults training or employee management).

In this work we present robotic constructions that facilitate team building at adults learning groups for cultural studies.

Fig. 1 Lego's Serious Play kit

Fig. 2 Lego's Serious Play for Adults Team Building

III. Project "Learn Traditional Dance with Robots"

During the 27th of June to 8th of July 2011, the Intensive Program "People and Space in the Borderland of Western Macedonia: Tracing historical, social and intercultural features" took place at the Educational Department of University of West. Macedonia in Florina. 25 postgraduate and undergraduate students from Holland, Cyprus and Greece participated. They followed daily courses, related to culture aspects of the area (history, architecture, sociology, etc.).

From the previous year, it has been cleared that team building activities would have been a proper start of the program, since students were unacquainted and faced problems initially in communication and cooperation. Because of the intensive character of the program, team building activities should have not been distractive or irrelevant to the courses' academic goal. On the other hand the initial courses were theoretical, with no opportunity for interactive activities.

To face those issues we came up with a schedule to implement robots in order to facilitate the team-building with activities relevant to the courses. We chose to design a cultural project on traditional dance and costumes. The topic was included in the program curriculum. So the purposes of the project were:

1) getting to know the culture of Florina (knowledge acquire) and

2) interaction, communication, familiarity and acquaintance between learners through activities with robotic constructions (team building).

The 25 participants were divided to 6 teams (1 group of 5 individuals, 5 groups of 4 individuals), in order to have small groups, according to previous researches. The teams were mixed to prevent aggregation of expatriates and possible acquaintance, which would compromise the second purpose of the survey.

Fig. 3 The common robotic platform used in the project

C. Robot architecture

According to Feil-Seifer and Mataric [5] socially assistive robots (SAR) must engage the user effectively, without need for user extensive training and has to be implemented with proper physical embodiment. Because of the lack of time we decided not to start from scratch, but to give the participants a common robotic platform as a base (fig.1, fig. 2). The robots were required to dance and so they were designed and constructed in order to move on the floor (towards both axes X & Y) and also to face in every direction (upper body torso rotation Rz). In order to synchronise its movement (dance steps) with the music a microphone was used, along with an ultrasonic sensor for collision avoidance. The dimensions of the robot were decided so it could be able to perform the "Zaramo" dance on a table, but also to be big enough in order to give to the participants the ability to dress it.

D. Team building activities

The educational process was divided into five phases. Each team was given a short questionnaire so each group would have to evaluate the other teams, at the end of each one of the five phases.

Phase 1: introductory or informative. Participants were informed about the general purposes of the scheduled bonding activities and the stages of these activities. Moreover they discussed the possibility of connecting robot activities with cultural goals (eg dance, theatre, social aspects, etc.).

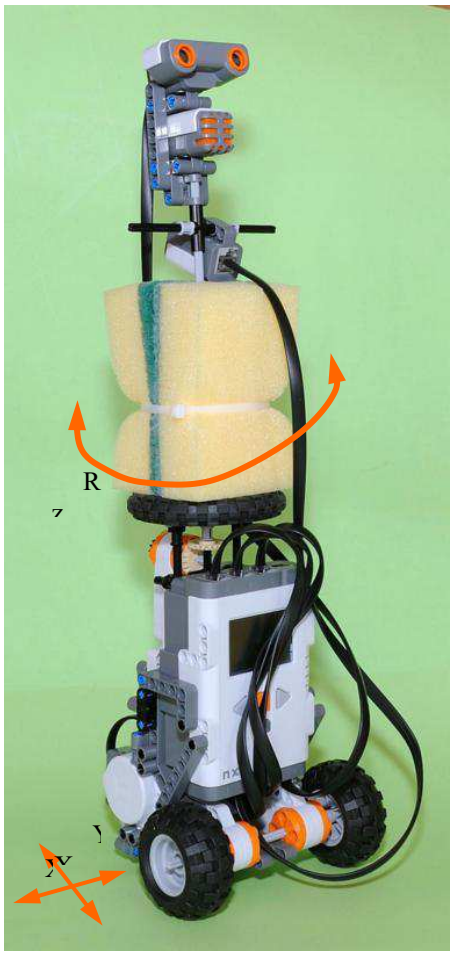

Fig. 4 The common robotic platform movements

In order to familiarize with cultural and traditional aspects of the city of Florina, participants were introduced with real authentic traditional costumes and watched videos about the local dance "Zaramo." The ensuing debate focused on the traditional clothing (colors, decorative items) and analysis of the steps of "Zaramo."

Phase 2: best costume contest. The content of this activity was the creation and decoration of traditional costumes, using a special pattern, which would help them to create a garment for the robot dancer. The teams worked at different work corners. Each group could obtain useful materials (corrugated paper in various colours, paper napkins in various colours and with various designs, ribbons, sea shells, markers, pencils, scissors, glue) for the decoration of its costume, from the special corner that was available for this purpose. After completing the costume, two sponges were placed on the

robotic construction, which would facilitate the placement of the costume on the robot.

Fig. 5 Robot costume construction

In the end, each group evaluated the other teams' costume. The evaluation criteria were the quality of the fabric (quality textile) and decoration of the clothing of the robot (art).

Fig. 6 Robot costume completion

Phase 3: contest about the synchronization of the robot motion with the repeating patterns of music and dance. In this phase, each team had to synchronize the movement of its robot according to the repeating patterns of dance - music. All robots "knew" how to dance Zaramo. The robots were programmed to start dancing "Zaramo" by the clapping of hands, to make the six steps of the dance, and then stop. So, every time a member - representative of the group was performing in the class, he was clapping his hands as many times as necessary in order to give rhythm to the robot mimicking the traditional ways, based on the music and patterns of Zaramo according to the video that was being played. At the same time, the other groups were rating the robot's motion control of contestant group.

In the end, all the robots were placed in the traditional circular shape, to dance Zaramo all together with the synchronized hand-clapping of all groups.

Fig. 7 Robot dancing completion

Phase 4: dance contest between groups. The goal of this activity was the transition of knowledge (dance learning) from the robot to the individual. The participants in order to learn Zaramo placed on the floor the 6 steps (in the form of footprints) of Zaramo, which had been designed on A4 papers. The practice was followed by a dance contest between the groups. Each team had to dance in a circle and was rated by the other groups, with evaluation criteria: 1) the rhythm, ie whether the sequence of steps combined with the music (slow or fast) 2) the steps, ie the movements of the legs were correct, based on the six dance movements and 3) the cycle, namely whether the team maintained the shape of the cycle during the dance.

Phase 5: The end of the team building activities. At the end, all participants were given an individual questionnaire that aimed to evaluate the educational process and to reflect on this new educational experience.

This questionnaire lasted 10 to 15 minutes and included the following open-ended questions:

- What did you like on this activity?
- In what topics/points did you work together?
- In what topics/points did you disagree with other members of the team?
- What game elements did you recognize in this activity?
- Have you seen something similar (fun with robots)? If you have seen, write the similarities or the differences.
- What did you learn doing this activity?
- Was this activity important? Why or why not?

Fig. 8 Dance contest between groups

Students rated their participation in the three competitions. In each competition, the groups evaluated one another. The rating (from 1 to 10) was carried out, on paper, based on specific evaluation criteria for each competition. The scores of the teams were announced at the end of the educational procedure. Table 1 shows the pooled results of six teams, for each of the three contests (best costume contest, contest motion control robot, dance competition between groups), that the groups attended.

TABLE I
THE FINAL RANKINGS OF THE TEAMS IN THE 3 CONTESTS

Teams			1	2	3	4	5	6
Robot	dress	Quality textile	43	38	35	39	38	34
		Art	43	38	35	38	39	35
	Motion control		36	37	36	37	37	39
Human	rhythm		41	42	35	33	38	41
	Steps		41	40	35	31	38	40
	Circle		41	45	38	35	42	42
	Results		245	240	214	213	232	231

IV. PROJECT EVALUATION – DATA ANALYSIS

For the assessment of the activities and results of the educational process, we used 2 tools: an instructor log (with data from observation and cam recorder) that was maintained all the way by a second observer and a questionnaire completed at the end of the program by the participants. In this way we had the capability to analyse data from [14]

the physical context
the human context
the interactive context
the project context

E. Observation data analysis

Based on instructor and observer log and also on the cam recorder we can evaluate the process of the team building according to the four team developing stages (Tuckman 1965). In the authentic costume and dance observation the participants were still hesitant and wandering about the nature of the project and how they would be able to combine the traditional costume and dance with robots. In the second stage, (after the first 20 minutes), they had already got to know each other and start the storming period. They tried to find their role in the team, but in a pleasant way, since the costume design and construction was fun, creative and triggered their imagination regarding the dressing of the robot. They carefully dressed up the robot and had fun while taking photos. In the third stage the participants got excited once thy learned from the instructor that they would be the ones synchronizing the robots' dance with their clapping and are eager to see how that would work out. The teams seemed to be in balance and unity, once they choose their representative without much ado. In the next activity, but at the same team-building stage, all participants tried their best in order to learn and carryout the Zaramo dance. They even hold hands and started dancing in circles which is considered a big step since such effort would have been fruitless at the beginning of the project. At the last stage of the team life cycle, they filled out the questioner, and they seemed happy that they learned the Zaramo without being heavily concerned of their grades.

F. Questionnaire data analysis

For the analysis of the open ended questionnaire we followed the quality discourse analysis.

Almost half of the participants (11/25) claimed that they liked the costume design/construction and the Zaramo dance. Another big group (10/25) liked the cooperation/collaboration between the team members and the team-building spirit. Few of them claim that they liked activity freedom (3/25) and creativity (2/25).

The majority of the participants (17/25) stated that they worked together in order to make the costume and to dance and the rest of them (8/25) stated that they cooperate in every phase of the project.

Almost half of the participants (11/25) claimed that there wasn't any disagreement point at their team and a same amount of participants (11/25) claimed that they had minor disagreements in the costume design activity, which is excused for the stage of storming.

Participants recognized many different game elements in the activities, like (10/25) synchronize robot dance and/or dressing robot, (9/25) cooperation with teammates, (6/25) contests and also (3/25) the general fun feeling.

The majority of the participants claimed that it was their first time participating in such activities and they considered them very innovative. Few of them (6/25) stated that they had similar experience with robot toys, Lego bricks and video-games such as Guitar Hero [21].

Half of the participants (13/25) claimed that through the activities they learned to dance Zaramo and design traditional costumes. Almost the same amount of participants (11/25) stated that they learned to cooperate within a team, few of them (5/25) learned robotics or just had fun (2/25).

In the total evaluation of the project some of them (10/25) stated that it was important since they learned close cooperation with in a teamwork. Other participants (9/25) answered in a similar way, claiming that they learned how to interact and have a close contact as team members. Few of them (6/25) considered the project important since they enjoied learning and (5/25) learned cultural aspects of Florina.

V. Conclusions

In the particular project we were interested in examining if robotic activities can offer a proper learning environment for cultural aspects and also proper context for team building for adults. From the project implementation and data analysis we saw that the project had a positive impact in both major goals: participants' team development and cultural learning.

We can consider robot exploitation as an important factor of the success. Robots served as dynamic tools. We took advantage of their construction and architecture, specially designed and adapted to our project needs (anthropomorphism, dimensions, etc,). Also the intelligence and interaction that robots brought to the activities captured the participants' attention. Questionnaire analysis showed that the combination of such a technology with cultural activities can offer a context not only suitable for learning, but also for team building. Social interaction with robots motivated participants to achieve progress in learning and to communicate/collaborate as a team.

Concerning the specific principles for adult learning and the project design and implementation, data analysis shows that participants got interested in this kind of knowledge (Zaramo dance, costume) and also got skills and attitudes (cooperation with in teamwork). In the rest of the duration of the program, participants continued to show their cooperative attitude.

Concerning the Maslow's Hierarchy of Needs and team life cycle, observations and questionnaire analysis show that participants involved in team building stages of forming, storming, norming and performing in a efficient way. They got their role in the team, by following a self-directed and actively participated learning path.

Through participants' responses we can see that robot costume design and guidance was the most communicational and co-operational part of the project, while Zaramo dancing was the most self expressive part, but their combination offers the context for adults team-building and cultural learning results.

VI. Acknowledgment

The authors would like to thank the project participants and faculty for their cooperation.

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