URBAN GAMERS LAB: Techniques and Tools to Develop Transversal Competences and Life Skills in Educational Context Using Technologies

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Abstract. Objectives. The URBAN GAMERS LAB project involves a multidisciplinary team (architects, engineers, and psychologists) to propose the activation of knowledge dissemination and digital transition of the younger generations in Emilia Romagna region, in Italy. Method and Study Phases. The project started in January 2022 and ends in January 2023. About 300 high school and university students, 50 teachers and municipal employees participated in the project. The study took place in three main phases: 1) from May to June the students attended lessons and workshops on how to use games in order to learn and develop skills such as problem solving, creativity, collaboration and negotiation using educational robots (Ozobot) and technologies (VR); 2) from September to November, students held lessons and workshops on gamification (how to build a video game) and functional use of technologies (e.g. online reputation), while municipal employees attended training courses on how to use gamification in order to develop skills useful for their duties; 3) monitoring and impact assessment phase: two questionnaires were administered to all those who participated in the project, one at the end of the first part of the June activities and one at the end of the November activities in order to verify the acquisition skills and project progress. Lastly, a final event was organized with the return of the results to all the project participants. Results and Conclusion. Results show an acquisition of problem-solving, negotiation and transversal competences in all participants with a high liking of the activities they had carried out during the planning phase.

Keywords. Digital Transformation, digital skills, problem-solving, creativity, educational robots.

1. Introduction

In response to the pandemic emergency, Information and Communication Technologies (ICT) have highlighted their potential in many fields, particularly in educational contexts. On the one hand, ICT-enabled distance learning and classes were carried on without interruption; on the other hand, the isolation of students was undoubtedly a negative aspect that influenced the ICT-enhanced educational context. The lack of social interaction and motivation leads to feelings of loneliness and dejection. Additionally, it strongly limited the ability to learn in a social context. This indicates a clear need to exploit novel technologies to promote a way of learning that is grounded in interactions and sociality. From Piaget's constructivist perspective, the process of understanding the world is the result of the relationship established between a thinking

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and acting subject and the object of his own experience. In addition, Papert underlined the importance of technological artifacts in learning, not as supporting this process but as in simulating reality. From Papert's point of view, knowledge cannot simply be transmitted as it is from one person to another, but each subject reconstructs information in a personal and original way. According to this, the use of technological devices (e.g., computers, tablets, and robots) represents an effective method for building knowledge, allowing students to apply the theoretical knowledge to practice. Even more, the use of a physical artifact (e.g., a robot, VR) determines an effective learning process as it makes students reflect about the knowledge they possess and how to apply it to the reality on which they are acting [1]. In [2,3] Papert highlights how the use of robotics kits, far from transmitting computer skills, generates curiosity and stimulates creativity and motivation to learn, allowing to build and enter in touch with powerful new ideas. Moreover, following the idea that learning is an active process based on experience and that social interactions can facilitate it, learners might make understanding more effective by working together. This means that technological innovation in education should be able to expand teachers/learners' opportunities for collaborative interaction and let them explore new strategies for teaching/learning [4]. Schools need to provide appropriate education in a ubiquitously digitalized world within complex and changing training needs and career landscapes. It has been highlighted that the citizens of the future are expected to develop critical thinking, problem solving, communication and teamwork, since these qualities have significant impact on the development of innovation. Communication, cooperation, and problem solving are, almost by definition, the future skills demanded. Together with ICT literacy, content creation abilities and safety constitute the so-called 21st century skills [5]. In this regard, URBAN GAMERS LAB project through its activities pointed to: 1) Promote awareness, especially among young people, regarding the importance of taking part in the digital transition, also defining the trajectories for the future of their city and region; 2) Allow students to recognize their talents through the creative and collaborative process; 3) Develop capacity building of municipality operators and librarians, through training workshops, for the dissemination of managerial skills with respect to gamification paths, thus promoting sustainability and autonomy in the proposition/participation of the projects; 4) Promote and support students in line with European Uninon DigComp programs, and with the digital agenda of the Emilia-Romagna Region, as well as in line with the guidelines of the Digital Agenda for Europe and with the objectives of the Italian Digital Agenda, in the development of transversal skills, life skills and competences such as critical thinking/problem solving, creativity, communication, collaboration, and ICT literacy; 5) Facilitate inclusion in digital transition processes on an urban scale through the game approach and adopting Game Thinking strategies. Participants were enabled to develop project ideas through a path of participation, knowledge growth and co-design of products and activities also using typical strategies of educational psychology (such as zone of proximal development and socio-cognitive conflict); and Game Thinking to solve specific challenges related to the territory (e.g., Emilia-Romagna region). The planned activities of the project, in addition to data collection for research purposes, were aimed at enhancing and integrating different realities (e.g., schools, university, library, etc.) of the municipality involved.

2. Method and Study Phases

Following the theoretical perspective described above, the general objectives of the project, and in line with the Digital Education Action Plan 2021-2027, the activities have been divided into two different moments: from May to June and from September to November 2022 and have been divided according to the areas of interest taken into consideration in this project.

2.1 Psychology based activities

Within the training module lasting about 2 hours a day for 5 days in the period of September and November, students had the opportunity to approach educational robotics. The activities have been designed to represent a constant challenge of increasing complexity to encourage involvement and interest: 1) Trial Test -> The first activity consists in analyzing the characteristics and functioning of the robot. Students are divided into groups of 4/5 and sheets; markers and 2/3 robots are provided for each group. In this activity, students draw on the sheet with markers and are encouraged to give free rein to their imagination and to search for information on how the robots work. After this first exploratory phase, information is shared, each group presents its findings, and the results are commented on together. 2) Code Test -> The second activity allows students to communicate with the robot using a sheet of codes, also in this case the activity is divided into an exploratory phase (in which they try to draw the codes and create paths) and a discovery sharing stage. 3) Robo-Rush -> The most complex activity is represented by a labyrinth in which students will have to identify the path (or paths) to get the robot to the central section of the labyrinth. The codes used and the time spent allow them to accumulate points, at the end of the activity compiled a ranking. The activity also provides for the identification of a "Team Leader" who guides the operations. 4) Debriefing -> Once the activity has been completed and the ranking has been drawn up, the Team Leader take the floor and comment the work done in the group, what worked and what didn't work. The speakers lead the students to reflect on communication methods, decision making and creativity, reporting concrete examples to introduce the topic of soft skills. Following the activities, theories and models of the main soft skills used during the day were presented. The focus was identified in getting students to reflect critically on the strategies and behaviors implemented during the activities, using a solid bibliographic base and an interactive presentation (facilitating questions and discussions on the topics presented).

2.2 Architecture based activities

Lessons were carried out in presence, with the help of the Discord digital platform as a private place, but easily accessible by students where they can interface with tutors and teachers in a less institutional form (unlike the systems already known and used by schools, such as Google Classroom). The platform also served as an exchange hub between different classes, thanks to the use of chat rooms reserved for individual student teams and others open to all teams from the various schools involved. The meetings were designed on "blocks" of a maximum of 3-4 hours in which theory and practice were mixed creating a unique experience. Brief explanation or introduction of a theme, followed by a connected activity played as much as possible by the participants and finally a reflection that often asked for a self-analysis or reflection on the part of the students. The leitmotif of the trainings was always based on three macro themes: 1) Design approach, following the Design Thinking methodologies, to provide participants with design tools; 2) Elements of psychology, to reflect on the more social and psychological aspects behind the game and playing; 3) Technological experimentation linked to the creation (concept and code) of video games. to learn the basics of programming and give a contemporary perspective of the world of work behind the gaming and video game market. Each meeting was thought of as a mix of theory and practice, thanks to varied activities and experiences useful for touching the concepts in question. The involvement of external guests, various professionals was also essential to give students perspectives from the academic and professional world. Each path began by giving the participants a contextualized design challenge on the city of Cesena, essential for creating engagement and an impact that was as visible as possible to male and female students. The idea of inserting small events within the itinerary integrated with the city of Cesena was an element that had the dual purpose of showing the city the projects in action, but also giving the students a concrete objective: a theater where they

could practice also the ability to tell one's ideas, to confront the city outside the classroom.

2.3 Engineering and Informatics based activities

Activities were divided as follows: in the morning the theoretical lessons were done (game design theory), while in the afternoon the practical activities (practical game design workshop) took place. The activities were based on the principles of: Collaborative design, Participatory design, educational game design. Then, for the game design lab, students were sorted into groups. The groups were mixed, creating heterogeneous groups that untangled the 'recurring' friendship groups. In this way we have tried to give birth to more unusual/original/heterogeneous ideas - as far as possible - from the meeting between students with different interests (compared to more consolidated groups of friends). Furthermore, forming groups in this way fostered the deepening of personal bonds between students. On a practical level, the activities saw the participation of 5 worktables (with 5-6 participants per group). The activity started with the choice of the type of game to develop videogame, serious game or boardgame. All groups opted for the board game. Next, we defined roles for each member of each group. Defining roles was necessary, given the large amount of work to be done. In this way, we have assigned each member a role (gameplay specialist, artist, lawyer, reviewer, IT specialist) a specific task. We therefore ensured that the projects could progress following specific objectives (from the definition of the game rules, the writing of the game manual, and even the graphic creation of the game board). Specifically, i) the gameplay specialist is responsible for defining the game rules and structuring the gameplay elements (scores, game progression, cards, rules, etc.). ii) The artist takes care of defining the aesthetic aspects of the game by taking care of the graphics of the boards, cards, pawns, etc. iii) The lawyer oversees writing the game manual, trying to make it as understandable as possible for new players. iv) the IT specialist has the task of creating the website, promoting the game by presenting it to an imaginary 'target' audience, furthermore the game creation process is also presented on the site. v) The reviewer is the most eclectic role, as he/she must work in close contact with the artist, lawyer, and IT specialist, checking their work and correcting the final products to guarantee their quality, while helping his fellow students or companions in the performance of their duties. The assignment of these roles has helped students in two ways: i) by dividing the complex project of creating a game into smaller and easier to manage tasks, ii) the choice of the role has been left to the individual members so that each could express their skills or interests, thus increasing their involvement in the activity, also through the sense of responsibility assigned. During workshops, the facilitators went around the tables helping the groups with their different requests and checked the progress of the individual projects. Furthermore, during the afternoon workshops, there were in-depth presentations on topics such as gameplay elements, board games, serious games - to suggest points of interest for the projects. On the last, single groups presented their games and in turn, each group tried the games of the other groups. In this way, changes and criticisms have been suggested based on the experience of external 'beta-testers'. Each group produced complete and playable board games in their entirety.

3. Results and Conclusion

The proposed questionnaire collects data relating to the students' perception of the activities carried out during the Urban Gamers Lab project. The items making up the questionnaire were created to highlight the expectations, expected utility, knowledge, and skills of the students in relation to technologies and their use in daily life. Within the project, two separate assessments were carried out at different times: "Questionnaire A" relating to the May design phase and "Questionnaire B" relating to the November phase. Both questionnaires were constructed using the logic of "forcing the answer", to proceed the respondent must necessarily answer all the previous questions. It is therefore not

possible to answer the Personal Data section, skip the Impact section and answer the questions relating to the Courses. However, it is possible to close the questionnaire at any time and not (permanently) answer the missing sections. This second eventuality explains why some participants did not complete the questionnaire; in each section we will report the number of participants who answered compared to the total. Here a summary of the principal results: 34 respondents to Questionnaire A, of which 19 answered all the sections, for Questionnaire B there were 64, of which 58 completed the questionnaire by answering all the sections. 1) Average age: Questionnaire A) 17 years (max 20; min 16), Questionnaire B) 16.39 years (max 17; min 15); 2) Gender: Questionnaire A) 28 Females, 6 Males, 1 Non-binary/third gender, Questionnaire B) 26 Females, 38 Males, 0 Non-binary/third gender. We then asked the participants about their perception of the project's usefulness and whether the activities carried out improved certain skills where 1 means "It has gotten much worse" and 5 means "It has improved a lot". 32 out of 34 (94%) answered these items for Questionnaire A and 63 out of 64 (98%) for Questionnaire B, in some items it is necessary to underline the difference between the general averages and the averages of those who compiled the questionnaire at 100% indicated in brackets: *Creativity* A) 3.69: Overall the activities were rated as useful in improving creativity (3.74) B) 3.63: 60% of respondents noticed an improvement in their creativity; *Problem Solving* A) 3.47: The ability to solve problems seems to be the skill least influenced by the proposed activities, although almost 25% of the respondents noticed an improvement. (3.52) B) 3.52: In the second questionnaire almost 54% of respondents noted an improvement in their ability to solve problems; *Communication*, As also expressed in the appropriate text boxes (which we will discuss later) the students appreciated the possibility of working in groups in all the proposed activities. A) 3.75: As can be seen from the average of the answers, the course had a positive impact on the communication skills of the participants. (3.84 in this case the average of the participants who completed the entire questionnaire increases by 0.9) B) 3.43: In the second evaluation, the average relative to the perception of improvement in one's own communication skills decreased, almost 43% of respondents answered positively. *Use of Technologies*, the competence perceived as most influenced by the project activities is related to the use of technologies. Within the project, programs and tools relating to the creation of video games were studied, as well as lessons on the functional use of technologies. A) 3.88: the only competence in which a decrease in the average is recorded by examining only the answers of those who filled out the questionnaire 100% (3.79) B) 3.83: Almost 78% perceived an improvement in their technical skills and in the functional use of technologies. *Decision Making*, this item was only included in the evaluation of the second part of the project, therefore it is not possible to report the averages of Questionnaire A. B) 3.35: 61% of respondents say they have not perceived any change in their ability to make decisions, while 33% say they have noticed an improvement in positive terms. *Leadership*, this item was only included in the evaluation of the second part of the project, therefore it is not possible to report the averages of Questionnaire A. B) 3.38: More than 36% noticed an improvement in their ability to lead a group of people, only 3 participants answered negatively to this item. In sum, these results show an acquisition of problem-solving, negotiation and transversal competences in all participants with a high liking of the activities they had carried out during the planning phase. This suggests an implementation of technologies and the dissemination of 21st century skills in educational contexts, fundamental for the preparation of students (and also teachers) for the future of education and job market.

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