International Journal of Research in Education Humanities and Commerce

Volume 06, Issue 03 "May - June 2025"

ISSN 2583-0333

21ST CENTURY SKILLS IN HIGHER EDUCATION: A DIFFERENTIATED LEARNING APPROACH

ELENI KOLOKOURI
Laboratory Teaching Staff, University of Ioannina, School of Education Sciences,
Department of Early Childhood Education

https://doi.org/10.37602/IJREHC.2025.6311

ABSTRACT

In the modern, globalized society, education must equip learners with 21st-century skills to prepare them for the complex professional, and civic roles. This study explores the views of university students of Early Childhood Education connected with the 21st century skills that are necessary for their professional development. Encouragement to use critical thinking, to collaborate, use of communication, creativity and innovation self-direction, global awareness, local awareness and problem solving were the categories examined through a questionnaire. Results show that 21st century skills were developed in isolation and not systematically as part of the curricula, which leads us to the conclusion that there is a need for further implementation of educational programs for 21st century skills until these skills are considered an integral part of education. Within this frame, an educational program was designed that focuses on critical thinking, collaborative processes and problem solving based on differentiated instruction. Integration of this program into university students' education fosters inclusive, skill-oriented learning environments that prepare future educators to meet the diverse needs of 21st-century learners.

Keywords: 21st Century skills, Differentiated Instruction, Educational Program

1.0 INTRODUCTION-THEORETICAL FRAMEWORK

The rapid emergence of digital technology, robotics, nanotechnology, artificial intelligence on the one hand, and the striving of education to prepare learners with cross-disciplinary knowledge, life skills and abilities for living in and protecting the globalized world of the 21st century on the other, have raised concerns about the identity of future citizens. STEAM Education has become a powerful tool towards this direction as it supports the development of skills of Science, Technology, Engineering, Arts and Mathematics, all of which invest on the development of the future citizens. (Plakitsi et al, 2018; European Commission, 2012; Next Generation Science Standards, 2013; OECD, 2022). Within this frame, it is crucial to connect lifelong learning with formal, non- formal and informal education at all levels of school education, university studies as well as adult learning. Lifelong learning has become a vital component of educational curricula that aim to personal development, social inclusion, employability of future citizens in a competitive globe and active citizenship towards a sustainable future. In this accelerating pace of change in economy and technology that has had an impact on education in the 21st century educational curricula, there is a strong need to develop student-centred learning environments that cover successfully the needs of a diverse population of learners with a variety of multi-cultural, multilinguistic and multi-ability needs.

Within this frame, 21st century skills are proposed to be integrated into the curricula of potential and current teachers so that they themselves are effective and their teaching meets the requirements of the 21st century (OECD, 2018). There is a strong need to develop student-centred learning environments that cover successfully the variety of multi-cultural and multi-ability needs of contemporary learners, so as to ensure high-quality education.

Differentiated instruction, (Tomlinson, 2001; Taylor, 2017) is a student-centred approach that acknowledges the wide range of readiness levels, interests, and learning profiles of different learners' needs that empowers teachers to design varied paths to learning so that each student can access content meaningfully, process ideas effectively, and demonstrate understanding in a way that reflects their strengths. This teaching method involves modifications in the content, process, product, and learning environment to meet the needs of different learners (Tomlinson, 2014). Characteristics such as flexible grouping, qualitative adjustments in task complexity, and the integration of multiple instructional strategies (like learning contracts, tiered assignments, and choice boards) help ensure that instruction remains rigorous and responsive. Moreover, assessment in a differentiated classroom is continuous and formative, guiding instructional decisions and emphasizing students' personal development rather than conformity to a fixed standard. The teacher's role becomes one of a mentor who provides structure and support, encourages student ownership of learning, and fosters a culture of collaboration, challenge, and mutual respect. Differentiated instruction thus offers not only a way to meet diverse learning needs but also a path toward a more equitable and intellectually vibrant classroom (Kivunja, 2015; Tomlinson, 2014).

In a globalized and multicultural society, 21st century skills in university education enhance students' educational experience and prepare them for their entry into different professional fields in order to respond to rapid technological progress as well as new work patterns. In alignment, the 4th Sustainable Development Goal of the 2030 Agenda, stresses the importance of equitable and inclusive education and provision of lifelong learning opportunities for all (UNRIC, 2017).

A series of research studies conducted (Alismail et al., 2015; Anderson et al., 2019; Kain et al., 2024; Mahmud et al., 2022; Ng et al., 2023; Silva, 2019) demonstrate the necessity of integrating 21st century skills at all levels of education and argue that this integration will enhance teacher training and lead to the modernization of teaching and learning. Integrating skills like critical thinking, collaboration, creativity, and digital literacy into the curricula equips students for global challenges and enhances students' abilities in areas such as adaptability, leadership, and cross-cultural communication. Furthermore, fostering a mindset of lifelong learning is essential in the face of rapid technological advancements and shifting job markets. These skills prepare learners for the demands of the modern workforce, where employers increasingly seek individuals who can think innovatively, work in diverse teams, and communicate effectively. Inclusion of the 21st-century skills into the curricula and pedagogical practices, can help educators create dynamic learning environments that reflect the of modern society and prepare students for the challenges ahead.

The Partnership for 21st Century Learning emphasizes that all learners, from early childhood through their careers, require educational experiences both in and outside of school to develop the knowledge and skills necessary for success in a globally and digitally interconnected world.

Representing over five million members of the global workforce, the Partnership brings together leaders from business, government, and education sectors across the United States and internationally to promote evidence-based education policies and practices. Their mission is to ensure that innovative teaching and learning become accessible to all. To achieve this, 21st-century standards, assessments, curriculum, instruction, professional development, and learning environments must be carefully aligned to create a comprehensive support system that fosters the essential outcomes students need to thrive in today's dynamic society (Lamb et al., 2017). Following the Partnership Framework for 21st century skills (2010), this study is connected with the following four categories of 21st century skills:

- Life and work skills: flexibility and adaptability, initiative, time management, independence, teamwork, productivity, leadership, social and intercultural skills.
- Learning and innovation skills: creativity, critical thinking, innovative thinking, problem solving, communication, collaboration.
- Global awareness: financial literacy, business literacy, active citizenship, environmental literacy.
- IMT skills (Information Literacy, Media Literacy and Technology Literacy): digital literacy, media literacy and technological literacy.

These skills offer a collective vision for learning in the 21st century framework, which is connected to the needs of learning communities considering life and career/professional development, learning and innovation in education, global awareness and different types of literacy that lead to responsible citizenship, information and media technology skills to achieve in dealing with problem solving situations in personal and professional life, education and citizenship.

2.0 METHODOLOGY

This study explores the views of university students connected with the 21st century skills that are necessary for their professional development and followed a quantitative design (Creswell, 2009). A total of 306 university students of Early Childhood Education, in Greece, during their third of studies participated in the survey, of which the vast majority were women, with the corresponding percentage amounting to 93.1% while the remaining 6.9% were men. The majority of the sample live in an urban area with the corresponding percentage amounting to 55.9%. 24.5% live in a rural area while 19.6% live in a semi-urban area.

A questionnaire with close-ended questions was distributed to the participants. The questionnaire was anonymous, and access was provided by a link in the Ms Teams e-platform as well as in the e-course platform of the University. The data collected were analysed through SPSS (v26). Aspects of the 21st century skills were examined divided in the following categories:

- Encouragement to use critical thinking
- Encouragement to collaborate
- Use of communication
- Creativity - Innovation
- Self-direction

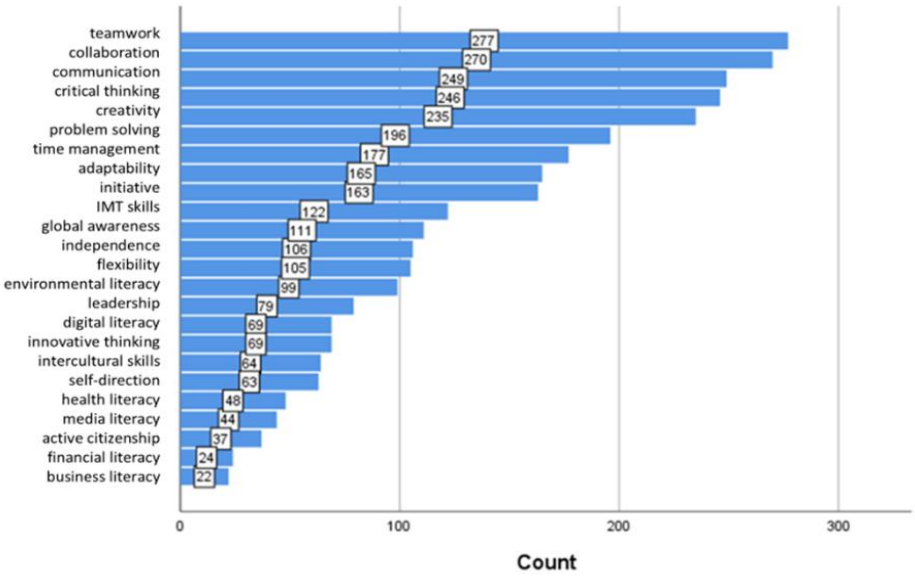
- Global awareness
- Local awareness
- Problem solving

These skills relate to the early childhood curricula in Greece and support lifelong learning and adaptability Moreover, they can be applied in a series of thematic areas of the curriculum and offer opportunities for learning through real-world situations (Penteri et al., 2022).

3.0 RESULTS

At the beginning, participants were asked to select from a series of 24 skills those that they had encountered in their school life as shown in the graph below (Graph 1). The skills that were encountered by more than 75% of the sample are teamwork (90.52%), collaboration (88.23%), communication (81.37%), critical thinking (80.39%), creativity (76.79%).

The skills that were selected by less than 25% of the sample are digital literacy (22.54%), innovative thinking (22.54%), intercultural skills (20.91%), self-direction 20.58%), health literacy 15.69%), media literacy 14.38%), active citizenship 12.09%), financial literacy 7.84%) and business literacy (7.19%).



Graph 1: Frequencies of skills that have been encountered in school life

As a next step, participants answered a series of six closed-ended questions, to indicate the frequency with which they were involved in school activities that require the use of 21st century skills categories such as encouragement to use critical thinking, encouragement to collaborate, use of communication, creativity, innovation, problem solving, self-direction, global awareness and local awareness.

Concerning the encouragement to use critical thinking, we can see (Table 1) that at a higher frequency participants were asked to summarize and give their own interpretation of a text they

had read or been taught during school years on average of more than 1-3 times per month (MT: 3.30 TA: 1.132). Correspondingly, 1-3 times per month, participants were asked to try to solve complex problems or answer questions for which there is not only one correct answer (MT: 3.00, TA: 1.130), but also to analyse different and conflicting arguments, perspectives or solutions to a problem (MT: 2.99 TA: 1.196). On the other hand, less than 1-3 times a month, participants developed convincing argumentation that was based on real-life facts and was justified (MT: 2.86 TA: 1.277) and compared information coming from different sources before completing a task (MT: 2.81 TA: 1.201). Finally, a little more than a few times participants were asked to draw conclusions that were based on numerical analyses, facts, or information relevant to the topic of the task (MT: 2.40 TA: 1.112).

Table 1: Mean and standard deviation of statements regarding the use of critical thinking

	Mean	Std. Deviation
Compare information from different sources before completing a task	2.81	1,201
Draw conclusions based on numerical analyses, facts, or information relevant to the topic of a paper	2.40	1,112
Make a summary and give your own interpretation of a text you have read or been taught	3.30	1,132
Analyse different and conflicting arguments, perspectives, or solutions to a problem	2.99	1,196
Develop a convincing argument that is based on facts and is well-reasoned.	2.86	1,277
Try to solve complex problems or answer questions for which there is not just one correct answer	3.00	1,130

Regarding the activities that encourage collaboration, we can see (Table 2) that mainly, participants were asked to work in pairs or small groups to complete a task more than 1-3 times a month, with the corresponding mean value being 3.26 (TA: 1.183). Correspondingly, slightly less than 1-3 times per month, they were called upon to collaborate with others to set goals and create an action plan for a team, with the corresponding mean value being 2.72 (TA: 1.175). Finally, a little more than a few times a year, participants were asked to create something common with the contribution of each member of the group (MT: 2.49 TA: 1.126), to present their group work to the class, to the teacher, or to an audience (MT: 2.42 TA: 1.032), to work as a group to provide feedback either on a group project or to create a shared product (MT: 2.35 TA: 1.104) and, finally, to provide feedback to their colleagues or on the work of a classmate (MT: 2.15 TA: 1.119).

Table 2: Mean and standard deviation of statements regarding encouragement for cooperation

	Mean	Std. Deviation
Work in pairs or small groups to complete a task	3.26	1,183
Collaborate with others to set goals and create an action plan for your team	2.72	1,175

Create something common with the contribution of each team member	2.49	1,126
Present your group work to your class, teacher, or other audience	2.42	1,032
Work as a team to provide feedback, or for a group project, or to create a shared product	2.35	1,104
Give feedback to your colleagues or a classmate's work	2.15	1,119

As far as the use of communication is concerned, we can see that communication skills seems to be present a few times a year (Table 3). Specifically, a little more than a few times a year, participants were asked to organize data for further use in written assignments or oral presentations (MT: 2.30 TA: 1.247). Correspondingly, a few times a year, they prepared and implemented an oral presentation to teachers or another audience (MT: 2.19 TA: 1.065) or even discussed how they would present their work or something new they had learned (MT: 2.13 TA: 1.064). Finally, less than a few times a year they presented and communicated their ideas in some other medium than the written word (MT: 1.91 TA: 1.086).

Table 3: Mean value and standard deviation of statements regarding the use of communication

	Mean	Std. Deviation
Organize data for further use in written assignments or oral presentations	2.30	1,247
Present and communicate your ideas through a medium other than the written word	1.91	1,086
Prepare and give an oral presentation to your teachers or another audience	2.19	1,065
Discuss how you will present your work or something you have learned.	2.13	1,064

In the table below (Table 4), we can see that almost all activities related to creativity and innovation are implemented with a frequency of a few times a year. In particular, less than 1-3 times a month seems that participants are asked to find a solution to a complex problem or an open-ended question (MT: 2.82 TA: 1.148), they generate ideas on how to address a problem or question (MT: 2.88 TA: 1.191) but also try out different ideas and try to improve them (MT: 2.56 TA: 1.227). Accordingly, less than a few times a year they seem to create an original product or make a presentation to express their ideas (MT: 1.95 TA: 1.010) or even use techniques such as brainstorming and concept mapping to organize their ideas (MT: 2.19 TA: 1.082).

Table 4: Mean value and standard deviation of statements regarding creativity – innovation

	Mean	Std. Deviation
Use techniques such as brainstorming and concept mapping to organize your ideas.	2.19	1,082

Generate ideas on how to address a problem or question	2.88	1,191
Try different ideas and try to improve them	2.56	1,227
Find a solution to a complex problem or an open-ended question	2.82	1,148
Create an original product or give a presentation to express your ideas	1.95	1,010

Regarding self-direction, we can see (Table 5) that less than 1-3 times year participants were asked to take initiative when they faced a difficult problem or question (MT: 2.64 TA: 1.346). On the other hand, several times year participants were asked choose the topic they wanted and formulate the questions related to it (MT: 2.17 TA; 1.148) to plan the steps to complete a complex task (MT: 2.37 TA: 1.200) but also to choose the examples they would like to study and the sources they would like to use (MT: 2.28 TA: 1.168).

Table 5: Mean value and standard deviation related to self-direction

	Mean	Std. Deviation
Take initiative when faced with a difficult problem or question	2.64	1,346
Choose the topic you want to learn about and formulate the questions related to it.	2.17	1,148
Plan the steps you will take to complete a complex task	2.37	1,200
Choose which examples you will study and which sources you will use.	2.28	1,168

For global awareness, we can see in the table below (Table 6) that participants are involved between a few times a year and 1-3 times a month in all activities related to global awareness. More specifically, they were asked to study information about other countries or cultures (MT: 2.51 TA: 1.035), to utilize information or ideas coming from other countries or cultures (MT: 2.31 TA: 1.073), to discuss issues related to global independence (MT: 2.56 TA: 1.052), to be able to understand the life experience of people in cultures beyond their own (MT: 2.54 TA: 1.087) and to think about how their own experiences and local issues are connected to global ones (MT: 2.46 TA: 1.071).

Table 6: Mean and standard deviation of statements regarding global awareness

	Mean	Std. Deviation
Study information about other countries or cultures	2.51	1,035
Utilize information or ideas that come from people in other countries or cultures	2.31	1,073
Discuss issues related to global independence	2.56	1,052
Understand the life experience of people in cultures beyond your own	2.54	1,087
Think about how your own experiences and local issues connect to global issues	2.46	1,071

Next, in the table below (Table 7) we can see that awareness at the local level was adopted in school classrooms slightly more than a few times a year. Several times a year, participants were asked to investigate issues related to their family or local community (MT: 2.48 TA: 1.093). With a corresponding frequency, they applied what they have learned to issues or problems related to their place (MT: 2.31 TA: 1.139) but also discussed with one or more members of the community in which they live about an action plan or an activity (MT: 2.09 TA: 1.121). Moreover, they analysed the way in which different members of the community or group deal with an issue (MT: 2.34 TA: 1.084) while they responded to an issue or question in a way that takes into account their concerns (MT: 2.15 TA: 1.010).

Table 7: Mean value and standard deviation of statements regarding awareness at the local level

	Mean	Std. Deviation
Investigate issues related to your family or local community	2.48	1,093
Apply what you have learned to issues or problems related to your place	2.31	1,139
Discuss with one or more members of the community you live in about an action plan or activity	2.09	1,121
Analyze how different community members or groups address an issue	2.34	1,084
Respond to an issue or question in a way that takes concerns into account	2.15	1,010

Regarding problem solving, we can see (Table 8) that participants during their school life tried to solve complex problems or answer questions for which there is not just one correct answer 1-3 times a month (MT: 3.00 TA: 1.130). Accordingly, they were asked to generate ideas on how to deal with a problem or a question less than 1-3 times a month (MT: 2.88 TA: 1.191). Moreover, they were asked to find a solution to a complex problem or an open-ended question less than 1-3 times a month (MT: 2.82 TA: 1.148).

Table 8: Mean and standard deviation of statements for problem solving

	Mean	Std. Deviation
Try to solve complex problems or answer questions for which there is not just one correct answer	3.00	1,130
Generate ideas on how to address a problem or question	2.88	1,191
Find a solution to a complex problem or an open-ended question	2.82	1,148

3.1 Comparative Study

A comparative study was held to examine the frequency with which the 21st century skills analysed above (Critical Thinking, Collaboration, Communication, Creativity – Innovation, Self-Direction, Global Awareness, Local Awareness, Problem Solving) were adopted in the

classrooms. As mentioned previously, to collect data for each of the above skills, participants asked to record the frequency with which they encountered related activities during their school life. In order to obtain an overall picture of each of the skills in question, the average value of the sentences - statements that constitute was calculated and, in this way, an aggregate scale was formed. It is obvious that the scale is expected to range from 1 to 5 with 1 corresponding to Almost never and 5 corresponding to Almost daily, while the intermediate ratings are assigned accordingly. Subsequently, and to comparatively study these skills, the average value was calculated, which, together with the standard deviation, is reflected in the following table (Table 9).

We can see that the skill that is found on average most often in the classroom is Problem Solving, which is found slightly less than1-3 times a month (MT: 2.90 TA: 0.938), followed by Critical Thinking (MT: 2.89 TA: 0.821). Correspondingly, between a few times a year and 1-3 times a month, Collaboration (MT: 2.57 TA: 0.932), Creativity – Innovation (MT: 2.48 TA: 0.881) and Global Awareness (MT: 2.47 TA: 0.893) are found. Finally, slightly more than a few times a year, Self-Direction (MT: 2.37 TA: 0.984), Local Awareness (MT: 2.27 TA: 0.866) and Communication (MT: 2.13 TA: 0.894) are found.

Table 9: Mean and standard deviation of 21st century skills

	Mean	Std. Deviation
Critical Thinking	2.8923	,82104
Cooperation	2.5670	,93191
Communication	2.1340	,89444
Creativity - Innovation	2.4791	,88137
Self-direction	2.3660	,98431
Global Awareness	2.4732	,89318
Awareness at the local level	2.2739	,86561
Problem Solving	2.8976	,93838

Next, it was examined whether there is a correlation between the frequencies of occurrence of 21st century skills in the classroom. For this purpose, the correlation coefficient Pearson, was calculated as in the following table (Table 10). We can see that a statistically significant positive linear correlation is found, moderately strong, among all 21st century skills. The fact that the correlation is positive suggests that with an increase in the frequency of occurrence of one skill in the classroom, an increase in the frequency of occurrence of the others is expected. A higher correlation is found between Creativity - Innovation and Problem Solving ($r=0.852$, $p<0.01$), while a weaker correlation is found between Communication and Global Awareness ($r=0.396$, $p<0.01$).

Table 10: Pearson correlation coefficient for the frequency of occurrence of 21st century skills in classrooms

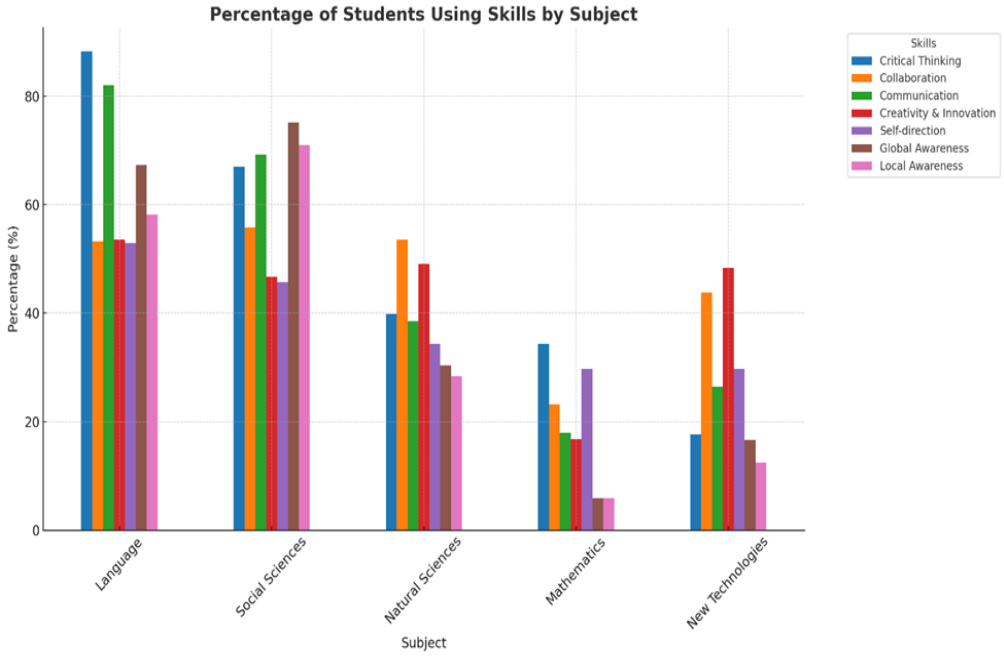
	1	2	3	4	5	6	7	8
1. Critical Thinking	1	,475**	,506**	,564**	,427**	,492**	,472**	,682**
2. Collaboration	,475**	1	,623**	,584**	,543**	,446**	,509**	,464**
3. Contact	,506**	,623**	1	,599**	,580**	,396**	,507**	,464**

4. Creativity - Innovation	,564**	,584**	,599**	1	,664**	,475**	,593**	,852**
5. Self-direction	,427**	,543**	,580**	,664**	1	,462**	,581**	,568**
6. Global Awareness	,492**	,446**	,396**	,475**	,462**	1	,570**	,476**
7. Awareness raising at the local level	,472**	,509**	,507**	,593**	,581**	,570**	1	,524**
8. Problem Solving	,682**	,464**	,464**	,852**	,568**	,476**	,524**	1

Note: **: p<0.01

3.2 Skill Development by Subject

Participants were asked to indicate the academic subjects in which they were encouraged to use different skills. We can see in the graph below (Graph 2), that language consistently emerges as the subject most strongly associated with critical thinking, communication, creativity, and self-direction. Social Sciences follow closely, excelling particularly in fostering global and local awareness, as well as collaboration. Natural Sciences show moderate levels of engagement across several skills, especially in collaboration and creativity. In contrast, Mathematics consistently ranks the lowest across nearly all skill areas, suggesting a more traditional and individual-focused learning experience. New Technologies, while lower in critical thinking, show a stronger presence in creativity and collaboration, reflecting the evolving nature of tech-based learning environments.



Graph 2: 21st century skills development by academic subject

The analysis explores the extent to which various 21st-century skills are cultivated within individual academic disciplines, based on student-reported experiences. The findings indicate that Language is the most holistic in its skill development, with particularly strong associations with critical thinking (88.23%), communication (82.03%), and global and local awareness. Moderate emphasis is also observed in creativity, collaboration, and self-direction.

In contrast, Mathematics reflects the lowest overall engagement with these skills, with critical thinking (34.31%) and self-direction (29.73%) being the most cited, while awareness and communication remain significantly underrepresented.

Natural Sciences prioritize collaboration (53.59%) and creativity (49.02%), with moderate levels of critical thinking and communication. Awareness-related skills are the least emphasized in this domain.

Social Sciences show a well-rounded skill profile, especially excelling in global awareness (75.16%) and local awareness (70.92%), followed by strong outcomes in communication and critical thinking. Creativity and self-direction, while present, are relatively less emphasized.

Finally, New Technologies are most closely linked with creativity (48.37%) and collaboration (43.79%), reflecting the innovative and project-based nature of the field. However, critical thinking, communication, and particularly global/local awareness are less frequently cultivated.

Overall, the results highlight clear disciplinary differences in the development of key skills, suggesting the value of a more integrated, cross-curricular approach to support comprehensive student growth.

4.0 PROPOSAL OF A 21st CENTURY SKILLS EDUCATIONAL PROGRAM

Results analysis has led to the conclusion that irrespectively of the degree to which 21st century skills are included in the University and Students' Education curricula, there is still a lot of steps to be made until they are considered a priority across all education levels, leading not only to upskilled professionals, but also to responsible citizens. 21st century skills were developed in isolation and not systematically as part of the Curricula, which leads us to the conclusion that there is a need for further implementation of educational programs for 21st century skills until these skills are considered an integral part of education.

Towards this end, an educational program was designed that focuses on critical thinking, collaborative processes and problem solving based on differentiated instruction. It is important to start with a clear understanding of the different needs of the learning community, evaluating how prepared students are in terms of 21st-century competencies. Based on this understanding, educators must carefully select appropriate parts of the curriculum and relevant courses where these skills can be systematically introduced and developed. The encouragement of open dialogue among students and educators regarding the significance of the 21st century skills and how they can be implemented in different learning environments is also crucial. Facilitating discussions around how critical thinking, creativity, collaboration, communication, innovation, self-direction, global and local awareness, and problem-solving are integral to educating responsible, adaptable future citizens. Innovative teaching strategies should actively engage students through disciplined yet flexible activities that spark curiosity and sustain interest.

The educational program related to the university courses 'Environmental Education' and 'Didactics of Science Education in the Early Years''. At the end of the educational program, university students are expected to:

- get familiar with the sociocultural approaches of Science Education through their connections with the Environment and Health

- be informed about the 17 Sustainable Development Goals and to recognize the importance of linking education for sustainable development with active citizenship

- design & organize educational materials for sustainable development for all

- develop skills & collaborate in order to engage themselves in global sustainability and inclusion

The educational program includes:

- Introduction to the subject of water, the teaching approach in the early years and the connection with the pre-primary school curricula. This part includes an introductory approach to water with basic information on its composition, properties, characteristics, distribution on planet earth and water cycle.
- Experiential workshop. Water experiments and links with Science Education, the Environment and Health.
- Experiential activities for raising awareness of university students about the 17 Goals of Sustainable Development and the Agenda 2030.
- Experiential workshop based on the short film: 'H2O, Our Future?' in which they approach water through a series of participatory activities.

The educational program offers opportunities for differentiating instruction by content, process, product, and learning environment through the suggested activities as shown in the table below (Table 11):

Table 11: Types of differentiated learning that can be found in the program

Differentiation type	Example
Content	In the introductory part, students can engage with content at different depths. Some may focus on the basic properties of water (composition, distribution, water cycle), while others with a stronger science background might explore complex environmental issues like water scarcity, pollution, or climate change impacts.
Process	The participatory activities linked to the short film 'H2O, Our Future?' can offer options like small-group debates, artistic interpretations (e.g. posters), or analytical discussions, allowing students to process the material through their preferred modes of learning (verbal, visual, kinesthetic).

Product	For the assignment on designing educational materials for sustainable development, students can choose how they present their work: Create a poster or infographic summarizing a sustainability issue. Design an interactive activity or a lesson plan for pre-primary students. Develop a short educational video highlighting water's importance linked to health and environment.
Learning environment	Online resources, discussion boards, and digital platforms can be used to extend the learning environment beyond physical classrooms, offering students additional ways to engage and collaborate asynchronously, especially for students with different scheduling or accessibility needs.

5.0 CONCLUSIONS AND DISCUSSION

In today's globalized and rapidly evolving society, education must equip learners with 21st-century skills to prepare them for the complex professional, and civic roles. This study highlights that although some efforts have been made in developing critical skills like collaboration, communication, and critical thinking, significant gaps remain, particularly in areas related to digital competencies, intercultural awareness, innovation, and financial literacy. The results of this study suggest that 21st-century skills are not yet a fully integrated part of the educational curriculum but are often developed incidentally rather than through intentional design. There is a pressing need for a more structured, cross-disciplinary approach that embeds these skills systematically across academic subjects. The findings of the study demonstrate that although 21st-century skills are increasingly recognized, they are often introduced sporadically rather than embedded systematically into the curriculum, resulting in inconsistent student experiences and preparation.

More specifically, analysis of the results reveals important insights regarding the development and integration of 21st-century skills in the educational experiences of university students. It was found that while skills such as teamwork, collaboration, communication, critical thinking, and creativity were highly encountered during school life, other essential competencies like digital literacy, innovative thinking, intercultural awareness, and financial and business literacy were less present. This uneven distribution highlights a partial integration of 21st-century skills into previous educational experiences, with some key areas, particularly technological and global competencies, lacking adequate emphasis.

Furthermore, the frequency analysis showed that critical thinking and problem solving were among the most frequently practiced skills, though still at moderate levels (around 1–3 times a month). Collaboration, creativity-innovation, and global awareness appeared with slightly lower frequency, while communication, self-direction, and local awareness were less systematically encouraged. This trend indicates that although some foundational 21st-century

skills are being cultivated, there is no consistent or structured approach across educational settings.

The correlation analysis revealed moderate to strong positive relationships between the different 21st-century skills, suggesting that when one skill is systematically promoted (e.g., creativity), others (e.g., problem solving) are likely enhanced simultaneously. This interrelation supports the argument for a holistic, integrated approach to skill development rather than treating these competencies in isolation. Moreover, a comparative analysis across academic subjects showed that Language courses most strongly support a wide range of skills, especially critical thinking, communication, and awareness, while Mathematics had the least integration of 21st-century competencies. Social Sciences stood out for fostering global and local awareness, emphasizing the role of humanities and social disciplines in building civic competencies. New Technologies supported creativity and collaboration but lacked consistent integration of critical thinking and global awareness.

To bridge this gap, the study proposes the design and implementation of an educational program that promotes critical thinking, collaboration, and problem-solving through differentiated instruction. The educational initiative developed around the courses "Environmental Education" and "Didactics of Science Education in the Early Years" serves as an example, offering experiential and differentiated learning opportunities that foster sustainable development competencies, active citizenship, and inclusion. This is aligned with research that shows puts emphasis on inclusive and adaptive teaching and learning in which that learners follow a common curriculum adapted and modified according to their specific needs (Westwood, 2013). In conclusion, advancing 21st-century skills education requires deliberate planning, curriculum integration, inclusive learning environments, and ongoing professional development for educators. Only through such comprehensive efforts can education truly prepare students to become skilled, responsible, and adaptable citizens of the future.

REFERENCES

Anderson, J., Lightfoot, A. (2019). The school education system in India: An overview. New Delhi, India: British Council.

Alismail HA, McGuire P. (2015). 21st Century Standards and Curriculum: Current Research and Practice. Journal of Education and Practice 6(6), 150-154.

Creswell, J. W. (2009). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. California: SAGE Publications.

European Commission (2012). Rethinking Education: Investing in skills for better socioeconomic outcomes. Communication from the Commission. Strasbourg: European Commission.

Kain, C., Koschmieder, C., Matischek, J. M., Bergner, S. (2024). Mapping the landscape: A scoping review of 21st century skills literature in secondary education. Teaching and Teacher Education, 151, 104739.

Kamran M., Namra M., M., R. Wattoo (2019). A Comparative Exploration of the Effect of Differentiated Teaching Method vs. Traditional Teaching Method on Students' Learning at 'A' level, Global Social Sciences Review 1, 61 - 66.

Kivunja, C. (2015) Exploring the Pedagogical Meaning and Implications of the 4Cs "Super Skills" for the 21st Century through Bruner's 5E Lenses of Knowledge Construction to Improve Pedagogies of the New Learning Paradigm. Creative Education, 6, 224-239.

Kolokouri, E., & Kornelaki, AC (2020). Introducing a New Socio-Cultural Tool for Science Education in First Grades: Scopes. In K. Plakitsi, E. Kolokouri, AC Kornelaki (Eds), e-Proceedings ISCAR 2019: Crisis in contexts (pp 88-102). Ioannina: University of Ioannina ISBN: 978-960-233-250-4.

Lamb, S., Maire, Q., Doecke, E. (2017). Key Skills for the 21st Century: an evidence-based review. A report prepared for the NSW Department of Education State of New South Wales (Department of Education).

Mahmud M., Wong S. F. (2022). Digital age: The importance of 21st century skills among the undergraduates, Frontiers in Education (7) 1-9.

Next Generation Science Standards. (2013). Retrieved from http://www.nextgenscience.org/

OECD. (2022). Teacher professional identity: How to develop and support it in times of change. Retrieved from https://www.oecd.org/education/teacher-professional-identity-b19f5af7-en.htm.

OECD (2018): Improving Learning Spaces Together, School User Survey. Retrieved from http://www.oecd.org/education/OECD-School-User-Survey-2018.pdf.

Penteri, E., Chlapana, E., Melliou, K., Filippidis, A., & Marinatou, Th. (2022). Curriculum for Preschool Education – Expanded Version (2nd Edition, 2022 IEP). In the context of the Project "Upgrading the Curricula and Creating Educational Materials for Primary and Secondary Education" of the IEP with MIS 5035542 (in Greek).

The Partnership for 21st Century Skills (2010). 21st Century Knowledge and Skills in Educator Preparation. Washington, DC. Retrieved from https://files.eric.ed.gov/fulltext/ED519336.pdf

Plakitsi, K., Stamoulis, E., Theodoraki, X., Kolokouri, E., Nanni, E. & Kornelaki, A. (2018). Cultural-Historical Activity Theory and Science Education: A new Dimension in STEAM Education (in Greek). Athens: Gutenberg.

Silva, E. (2009). Measuring Skills for 21st-Century Learning. Phi Delta Kappan, 90(9), 630-634.

Taylor, S. C. (2017). Contested Knowledge: A Critical Review of the Concept of Differentiation in Teaching and Learning, Warwick Journal of Education - Transforming Teaching, 1, 55-68.

Tomlinson, C.A. (2014) The Differentiated Classroom: Responding to the Needs of All Learners, 2nd Edition, U.S.A.: Association for Supervision and Curriculum Development.

Tomlinson, C. A. (2001). How to Differentiate Instruction in Mixed-Ability Classrooms. 2nd Edition. U.S.A.: Association for Supervision and Curriculum Development.

United Nations Regional Information Center. (2017). Retrieved from https://www.unric.org/en/

Ng, D. T. K., Leung, J. K. L., Su, J., Ng, R. C. W., & Chu, S. K. W. (2023). Teachers' AI digital competencies and twenty-first century skills in the post-pandemic world. Educational Technology Research & Development, 71(1), 137–161.

Westwood, P., (2013). Inclusive and Adaptive Teaching. London: Routledge

