Activity Kit

WP3 – CO-DESIGN OF THE OUR DIGITAL VILLAGE ACTIVITY KIT AND EVALUATION TOOLS

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Contents

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Abbreviations

ODV = Our Digital Village

ESIF = European Structural and Investment Funds

ICT = Information and communication technology

PBL = Project -Based Learning

PBL = Problem - Based Learning

IBL = Inquiry - Based Learning

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1. Introduction

The Our Digital Village Project

Rapid digital transformation has influenced education, work and life and the Covid-19 pandemic has only highlighted more the divergences linked to digitisation in some territories, especially between urban and rural areas, and the need for innovation in education to respond to these challenges.
For this reason, Our Digital Village (ODV) aims to intervene in rural areas by promoting the acquisition of digital and transversal skills, preparing people to face the challenges of the future. It will do so by co-creating high-quality educational content that responds to the needs of the local context, while simultaneously ensuring the long-term transformation towards digitalization through active awareness raising on all levels of society.
Through self-analysis workshops, the intrinsic motivation to change will be explored, and the needs of each local context will be identified. These will be taken in mind while co-designing the educational materials, followed by a training for teachers and trainers to ensure their capacity to implement the co-designed activities with their learners.

The Activity Kit

Description

The "Our Digital Village" Activity Kit aims to bridge the digital divide in rural areas by fostering the acquisition of digital and transversal skills. Designed primarily for educators, including teachers and trainers who wish to incorporate digital education into their curricula, the Activity Kit serves as a comprehensive tool. It empowers educators with the knowledge and resources to conduct effective digital education sessions, benefiting both young and adult learners in formal and non-formal educational settings. By facilitating access to theoretical and practical elements of contemporary educational ICT topics, the Kit enables educators to deliver innovative and effective teaching methods. Consequently, learners are equipped with essential skills for academic success and future employment opportunities, ensuring a broad and impactful enhancement of the educational experience across the board.

The Activity Kit's design reflects a commitment to flexibility, adaptability, and learner-centered education, enabling educators to tailor their teaching

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approach to the specific needs of their students while fostering an engaging and enriching learning environment. It consists of:

1. **Information on Digital education** in the EU and in the ODV project countries
2. **Pedagogical Guidelines**: A set of instructions and recommendations for educators on how to effectively use the Activity Kit.
3. **Lesson Plans examples**: Detailed guides for structuring ICT courses, including objectives, materials needed, and step-by-step instructions for conducting each session.
4. **ICT Challenges**: Practical, problem-based activities that encourage learners to apply digital skills in real-world contexts.
5. **Extra Resources**: Additional materials such as articles, podcasts, apps, and platforms that provide further reading and exploration opportunities.

Target Groups

The Activity Kit is primarily designed for educators, including teachers and trainers, who are looking to integrate digital education into their curricula. These educators are the direct target group of this Kit. The aim is to equip them with the necessary tools to implement digital education sessions effectively within their schools/classes with young and adult learners. The use of the Our Digital Village “Activity Kit" will be facilitated by the knowledge gained and capacity built through the introduction of the training outline to educators before using the Activity Kit.

Young and Adult Learners in formal and non-formal educational settings will also benefit significantly by the application of the Activity Kit, as they constitute the main beneficiaries targeted by the Kit. Learners will have the opportunity to delve into theoretical and practical elements of current educational ICT topics and to experience more innovative and effective teaching methods, that will make them better prepared for the demands of the digital age. By engaging with educators trained in the latest digital education techniques, learners will acquire essential skills that are crucial for academic success and future employment opportunities.

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This dual focus ensures that the Activity Kit has a broad impact, directly enhancing the skill set of educators while indirectly benefiting learners by providing them with a more enriching and relevant educational experience.

How to use this Activity Kit

The Activity Kit, designed for educators, including teachers and trainers, aims to integrate digital education seamlessly into their curricula. Before utilizing the kit, educators are provided with training to familiarize them with the materials and methodologies encompassed in the kit. This preparation ensures they are well-equipped to conduct effective digital education sessions. The kit serves both young and adult learners across formal and non-formal educational settings, offering theoretical and practical insights into current ICT topics. By employing innovative teaching methods learned through the kit, educators can offer learners a comprehensive education that not only prepares them for the digital age but also enhances their employability and academic success.

The distribution of the "Our Digital Village" Activity Kit is crafted with a strategic emphasis on adaptability to cater to the diverse contexts in which it will be employed. Acknowledging the varied educational landscapes, this approach ensures the Kit's application is both relevant and effective.

Educators are welcome to tailor the deployment of the Activity Kit to align with the unique requirements and interests of the educators and learners. This involves flexibility in the allocation of time across different segments or activities to meet the educational goals while respecting the availability of participants. Embrace flexibility in modifying or reconfiguring the activities proposed in the Kit to better accommodate the learning preferences and objectives of the educators and learners involved. This may involve for example extending activities that are of particular interest or relevance to the participants.

2. Digital Education in the EU context

The COVID-19 pandemic highlighted the necessity of enhancing digital education in Europe while also revealing the shortcomings and needs of educational institutions. European Member States made substantial investments in digital education, specifically in digital infrastructure,

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supported by Structural Funds in the decade 2010-2020[1]. Despite significant progress in the digital infrastructure of schools over the past decade, substantial disparities persist among countries. The share of students attending highly digitally equipped and connected schools differs widely across Europe, being highest in Nordic countries, and ranges from 35% (ISCED 1) to 52% (ISCED 2) to 72% (ISCED 3)[2].

Prior to the onset of the coronavirus crisis, teachers were insufficiently trained to integrate digital technologies into the classroom, which was not consistently aligned with the investments made in digital infrastructure and tools. On average in the EU, fewer than half of teachers (49.1%) report that ICT was included in their formal education or training[3].

Pupils' digital skills are improving, but they are not digitally native. Contrary to the common view of the young generation of today as a generation of "digital natives", the ICILS results indicate that young people do not develop sophisticated digital skills just by growing up while using digital devices.[4] Across the European Union, the phenomenon of underachievement in basic ICT operations among students is very common. In 2018 62.7% for Italian pupils, 50.6% in Luxembourg, 43.5% in France, 33.5% in Portugal, 33.2% in Germany, 27.3% in Finland, and 16.2% in Denmark did not manage to surpass the underachievement threshold (ICILS 2018)[5].

Under the strategic framework of the European Education Area, the EU engages in enhancing the efforts and collaboration between European Union Member States and key stakeholders to prepare for the transition to the digital age. In 2018 the EU adopted the first Digital Education Action

[1] European Commission, Directorate-General for Education, Youth, Sport and Culture, Education and training monitor 2020 – Executive summary, Publications Office, 2020, https://data.europa.eu/doi/10.2766/581621

[2] ibid

[3] ibid

[4] ICILS results are presented in:
Fraillon, J. Ainley, J., Schulz, W., Friedman, T., Duckworth, D. (2019). Preparing for Life in a Digital World: IEA International Computer and Information Literacy Study 2018 International Report. Amsterdam: International Association for the Evaluation of Educational Achievement (IEA).
Fraillon, J. Ainley, J., Schulz, W., Friedman, T., Gebhardt, E. (2014). Preparing for Life in a Digital Age: the IEA International Computer and Information Literacy Study International Report. Cham: Springer.

[5] ICILS 2023 report will be published in November 2024.

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Plan (2018-2020)[6], which was renewed in 2020 (Digital Education Action Plan 2021-2027)[7] setting out a common vision of high-quality, inclusive and accessible digital education in Europe and aiming to support the adaptation of the education and training systems of Member States to the digital age. The renewed Action Plan designs two priorities: 1. Fostering the development of a high-performing digital education ecosystem and 2. Enhancing digital skills and competences for the digital transformation[8]. There is no mention of special measures for rural areas, however, the need to effectively manage the risks of the digital transformation, including the risk of an urban/rural digital divide is underlined in the Action Plan.

The Action Plan for Digital Education 2021-2027 also includes the establishment of a European Digital Education Hub, serving as a (ESIF) has been pivotal in enhancing information and communication technology (ICT) infrastructure in schools. However, the prevalence of traditional equipment, limited digital device availability for students, and challenges in ICT technical support pose hurdles to comprehensive digital education.

Italy, ranking low in DESI 2022, adopted a National Strategy for Digital think-tank to support policy and practice development while monitoring the progress of digital education in Europe. The Hub's role extends to fostering user-driven innovation and facilitating engagement through events like the Digital Education Hackathon[9].

In 2023, the European Union emphasised the importance of digital skills for adult learners, with initiatives like the European Year of Skills aimed at boosting participation and enhancing talent across the member states. While the EU target for 2030 is having at least 80% of adults with basic

[6] European Commission. (2018). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Digital Education Action Plan*. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0022&from=EN

[7] European Commission. (2020). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Achieving the European Education Area by 2025*. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0624

[8] European Commission. (2020). *Digital Education Action Plan (2021-2027)*. https://education.ec.europa.eu/focus-topics/digital-education/action-plan

[9] European Commission. (2020). *Digital Education Action Plan: Factsheet*. https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-factsheet-sept2020_en.pdf

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digital skills, challenges remain, as 4 out of 10 adults in Europe lack basic digital skills[10].

Importance of the acquisition of digital and transversal skills for teachers/trainers

In today's rapidly evolving educational landscape, the acquisition of digital and transversal skills by teachers and trainers is of paramount importance. This shift is not merely a response to technological advancements but is fundamentally tied to the need for educators to effectively prepare students and learners of all ages for the challenges and opportunities of today's world.

Digital skills, as outlined in frameworks like DigCompEdu[11], are essential for educators to navigate the ever-expanding array of educational technologies. These skills empower teachers and trainers to create dynamic and engaging learning environments, leveraging digital tools and resources to cater to diverse learners needs. One of the objectives of continuous teacher and trainer learning is to support educators acquiring digital proficiency to enhance their teaching methods [12].

Beyond technical proficiency, transversal skills, including critical thinking, problem-solving, communication, and collaboration, play a pivotal role in shaping a well-rounded educational experience. The International Society for Technology in Education (ISTE) Standards for Educators[13] further underscores the importance of communication and collaboration in a globally connected world. These transversal skills not only contribute to academic success but also prepare students for the demands of the future workforce as well as they increase the employability of potential adult

[10]European Commission. (2023). *European Year of Skills 2023*. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-year-skills-2023_en

[11] European Commission. (2017). *The Digital Education Action Plan*. https://op.europa.eu/en/publication-detail/-/publication/fcc33b68-d581-11e7-a5b9-01aa75ed71a1/language-en

[12]Darling-Hammond, L., & Richardson, N. (2009). Teacher learning: What matters? *Educational Leadership, 66*(5), 46-53.

[13] International Society for Technology in Education. (n.d.). *ISTE Standards*. Retrieved from https://iste.org/standards

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learners. The World Economic Forum's Future of Jobs Report (2023)[14] emphasises the need for skills such as analytical thinking and creativity, skills that teachers and trainers equipped with transversal competencies can effectively impart to their learners.

In essence, the acquisition of digital and transversal skills is not just a matter of professional development for educators; it is a prerequisite to providing students and learners of any age with a holistic and future-ready education. As the educational landscape continues to evolve, teachers and trainers equipped with these skills will be instrumental in shaping the next generation of learners who are not just academically proficient but also agile, creative, and well-prepared for the challenges ahead.

3. Digital Education in ODV countries

ODV countries are actively working to enhance digital education, addressing challenges and adopting comprehensive strategies to improve digital skills, infrastructure, and overall educational outcomes.

Austria has been proactive in advancing digital education through its 2018 Master Plan for Digitalization in Education. The plan, slated for implementation in 2023, focuses on teaching content, teacher training, and school infrastructure. The 8-Points-Plan for the "Digital School" includes initiatives such as the Digital School portal, a massive open online course for pedagogic staff, and expanding basic school IT infrastructure. Austria aims to improve its Digital Economy and Society Index (DESI) ranking, currently at 10th place, through these comprehensive measures.

Cyprus strategically positions digital education in its national transformation, aligning with the '**Digital Strategy for Cyprus (2020-2025)**' and the 'Digital Skills - National Action Plan 2021-2025.' Focusing on basic digital and software skills, Cyprus aims to create an inclusive, open, and digitally skilled society. The upcoming reactivation of the National Coalition for Digital Skills and Jobs demonstrates a commitment to collaborative efforts involving the public sector, academia, and the private sector.

[14]World Economic Forum. (2023). *The Future of Jobs Report 2023*. https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf

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Greece, while making efforts to modernise its digital infrastructure, faces challenges. Funding from European Structural and Investment Funds Skills in 2020. The strategy focuses on Digital Education, Digital Citizenship, and creating a non-discriminatory digital environment. With an Operational Plan in place, Italy aims to raise digital skills, eliminate gender gaps, and triple ICT graduates. The reform of the professional education and training system underscores Italy's commitment to digital teaching and innovative learning environments.

Poland, positioned 24th in DESI, has consistently improved its score above the EU average. The government prioritises digitalization for a favourable business environment and plans for a digitization policy for education in 2022. The Recovery and Resilience Plan allocates a significant portion to digital transition, emphasising education, digital skills, network deployment, and e-services in public administration. The ongoing Digital Competence Programme (2020-2030) further contributes to developing digital skills among various stakeholders.

Portugal, ranked 16th in DESI, stands out in various indicators, including IT specialists, SMEs selling online, and digital public services. The success of initiatives like the Upskill program[15] and 17 Digital Innovation Hubs reflects the positive impact of the Digital Transition Action Plan. This plan, implemented with other initiatives, showcases Portugal's commitment to digital education and fostering a digitally skilled society.

Romania, despite ranking last in DESI 2022, has made strides in its national digital education context. The country emphasises infrastructure, curriculum, teacher training, and digital inclusion. However, challenges persist, including ensuring equitable access to technology, addressing the digital skills gap among educators, and adapting to rapidly evolving technologies.

Across the ODV European countries, self-analysis workshops with participants from local rural and peri-urban communities carried out during 2023 have unveiled key insights into the digital education landscape.

[15]Upskill. (n.d.). Retrieved from https://upskill.pt/

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In **Austria**, 48 participants, including students, adult learners, and trainers, emphasised the role of schools in promoting digital skills. Participants expressed a desire for advanced skills and exploring new technologies, as well as underlined the importance of online safety. Collective learning and tailored online platforms were identified as crucial.

Cyprus' 43 participants, including students, educators, and community members, highlighted critical needs such as updated equipment, comprehensive training, and a shift to digital tablets. A collective desire for enriched learning experiences through advanced digital tools was highlighted, along with improved communication channels.

Greece's 43 participants, including students, educational staff, parents, and adult learners, exhibited clear desires for fundamental digital skills. Students were keen on computer usage and online research, while adults focused on the digitalisation of services and practical uses of technology. Teachers emphasised the need for upgraded school facilities.

In **Italy**, 37 participants, comprising students, teachers, adults, and policymakers, aimed for enhanced digital skills. The community's focus included the promotion of the territory, deepening technologies for everyday life, and improving both basic and advanced digital skills. There was an interest in the project's five targeted technologies.

Romania organised workshops in four communities, with 41 participants expressing the widespread use of digital tools in daily life. However, there was a low level of knowledge concerning emerging technologies due to a lack of local training. Digital skills were defined as using gadgets and digital platforms, and solving problems online.

Poland's 30 participants showcased diverse digital skills, with proficiency in various tools. Social networks played a central role, indicating a nuanced understanding of digital skills shaped by individual preferences. The participants prioritised effective ICT tool use and highlighted the need to actively contribute to digital spaces.

Portugal's 35 participants from diverse backgrounds highlighted the autonomous acquisition of digital competences. Different target groups demonstrated varying needs, but common concerns emerged, particularly

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regarding the use of digital skills for community purposes like public services and communication.

In summary, these self-analysis workshops reveal a rich tapestry of digital education needs and aspirations across European countries, highlighting the importance of tailored approaches, community-specific solutions, and a collective commitment to bridging the digital divide.

Online survey results

In order to understand how teachers and trainers from the countries involved in the project perceive the current situation regarding digital education, in terms of resources, skills, and integration of educational pathways, an online survey has been drafted and proposed. Below, we present an analysis of the results based on the responses obtained.

97 teachers and trainers participated in the survey, respectively:

- 11 from Romania
- 23 from Portugal
- 15 from Poland
- 14 from Italy
- 14 from Greece
- 10 from Cyprus
- 10 from Austria

The online survey was predominantly assigned to teachers, with a fairly even distribution among primary school teachers, lower secondary school teachers, and upper secondary school teachers (Figure 1-2).

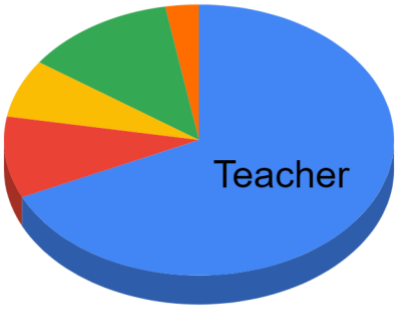

Figure 1 - Role

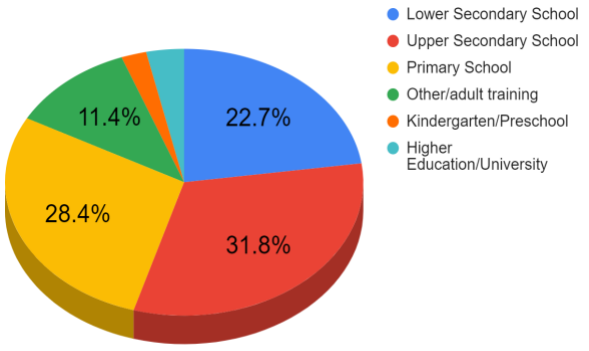

Figure 2 - Level/Grades

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All respondents stated that they normally have access to tools for digital teaching in their institution/organisation, with a prevalence of "Computers" (95%) and "internet access" (84%), while tools such as "robotics kits" (22%) and "virtual reality devices" (12.5%) are less frequently available.(Figure 3)
Regarding access to resources to support digital teaching, the majority (87.5%) indicated "video" resources, while "quizzes" and "online classes" were selected by about half of the respondents.(Figure 4)

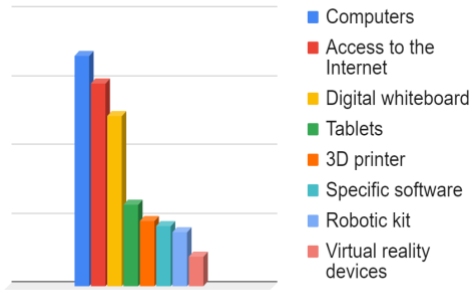

Figure 3 - Normally used tools

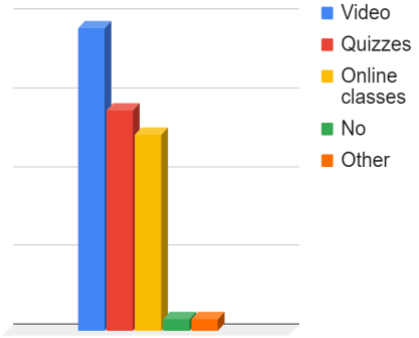

Figure 4 - Support digital resources

More than half of the respondents (55.2%) stated that their institution/organisation is "sufficiently equipped with Information and Communication Technologies (ICT) tools to support digital education." (Figure 5). Among those who do not consider their institution/organisation sufficiently equipped, 42.5% believe that "Upgraded/Improved equipment" is needed, while 25% believe that "increasing devices per classroom" is necessary. (Figure 6)

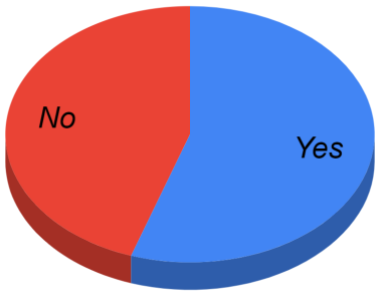

Figure 5 - Sufficiently equipped

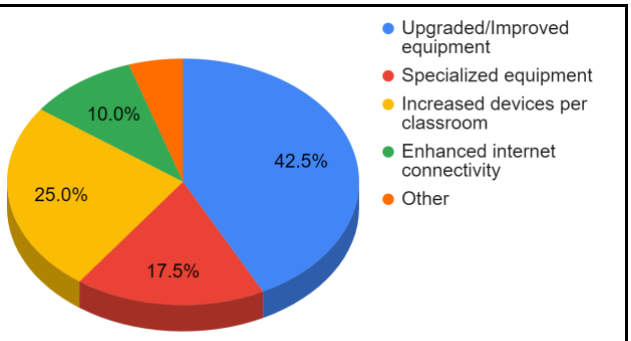

Figure 6 - Improving needed

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The majority of respondents reported having taken online courses on digital education (Figure 7), and their opinions (open-ended responses) showed a fairly even split between those satisfied , those with a descriptive opinion about the content, and those dissatisfied or in need of further insights (Figure 8).

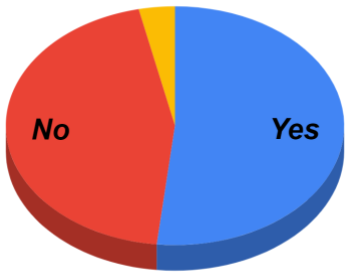

Figure 7 - Courses attended

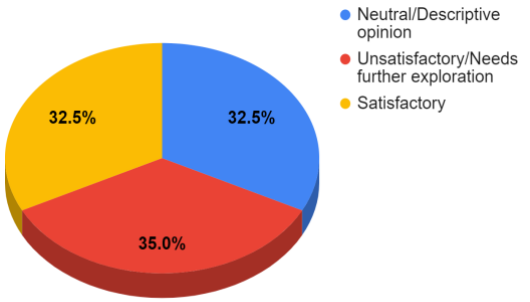

Figure 8 - Opinion on courses

In fact, to the specific question *"Do you think there is a need for further training opportunities in digital education to enhance your skills?"* almost all respondents answered that yes, there is this need (Figure 9).
Regarding the level of integration of "digital education" into the school curriculum or teaching plans, 71.4% stated that it is only "partially integrated" (18.7% Fully integrated - 9.9% Not integrated) (Figure 10).

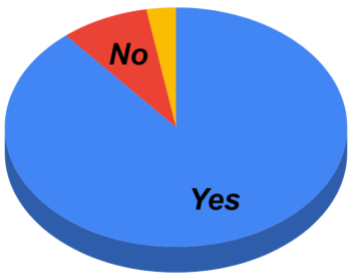

Figure 9 - Need for further training

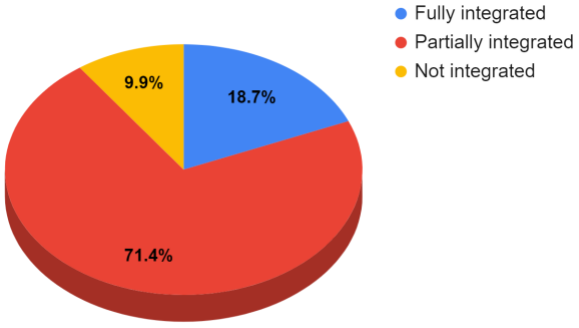

Figure 10 - Level of integration

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Respondents were asked an open-ended question: "What do you consider to be the main challenges in the implementation of education in your school/institution?" The responses were analysed and categorised into six different categories ranging from "cost management" to "time management," but the category that seems to prevail, consistent with the earlier part of the survey, is "Training teachers to effectively use digital tools" (72%) (Figure 11).

Regarding opportunities to improve learning through the use of digital technologies, open-ended responses were analysed and categorised, **with the predominant category being "Enhanced Engagement and Fun Learning"** (50%) (Figure 12).

Figure 11 - Main challenges

Figure 12 - Opportunities

The majority of respondents believe that their institution/organisation is engaging students in digital learning (Figure 13). The responses on how this happens, in open-ended format, were categorised, and those related to "Digital Resources and Research" as tools for engaging students prevailed, while only a minimal part implied "Innovative Teaching Methods" (Figure 14).

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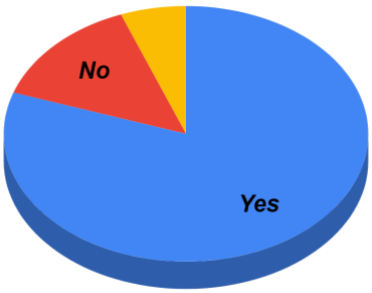

Figure 13 - Students engagement

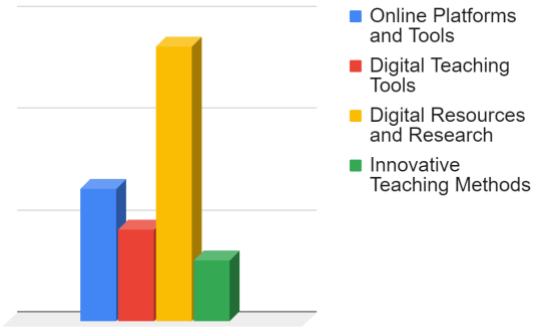

Figure 14 - How students are engaged

Respondents were asked to provide an evaluation of the level of competence of their students in terms of digital skills, and about half believe that the level of students is "basic" (Figure 15).

On the topic of "online security," a specific multiple-choice question was posed regarding the tools adopted by the respondent's institution/organisation. Respondents rarely selected only one response but often a combination of them; the most frequently selected ones were "promoting responsible behaviour," "secure passwords," and "teaching online safety," while the presence of a "cybersecurity team" seems to be one of the less utilised tools (Figure 16).

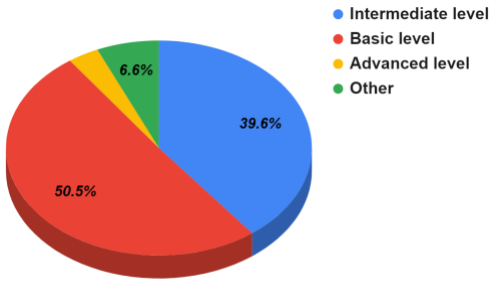

Figure 15 - Level of competence

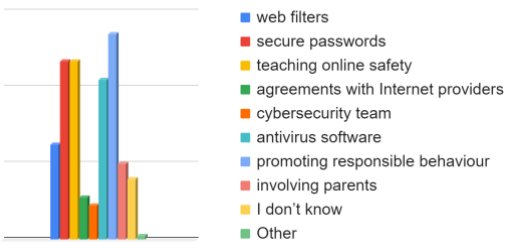

Figure 16 - Online security

Five possibilities were presented, selectable in a multiple-choice manner, to "ensure accessibility to digital resources for students with disabilities or special needs"; the most frequently selected was "promote a culture of

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awareness," **but it is noteworthy that 25% of respondents declared not knowing how to answer this question** (Figure 17).

Only a small portion of respondents (12.1%) believes that in their institution/organisation "there are enough financial resources to support digital education," while the remaining respondents either believe it is not the case (44%) or do not know how to respond (42.9%) (Figure 18).

Finally, respondents were asked, "What are your priorities for the update and future development of digital education in your school/institution?" and the predominant opinion is that "Providing ongoing training for teaching staff on the effective integration of digital technologies" is needed (Figure 19).

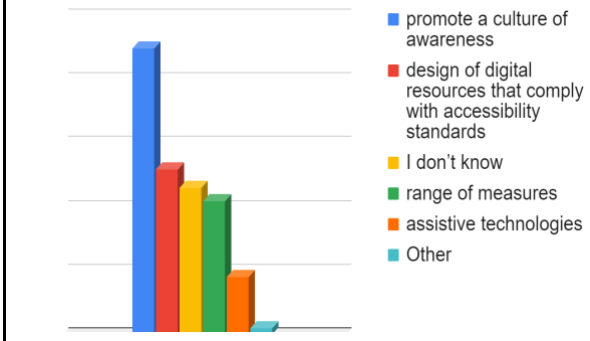

Figure 17 - Accessibility

Figure 18 - Financial resources

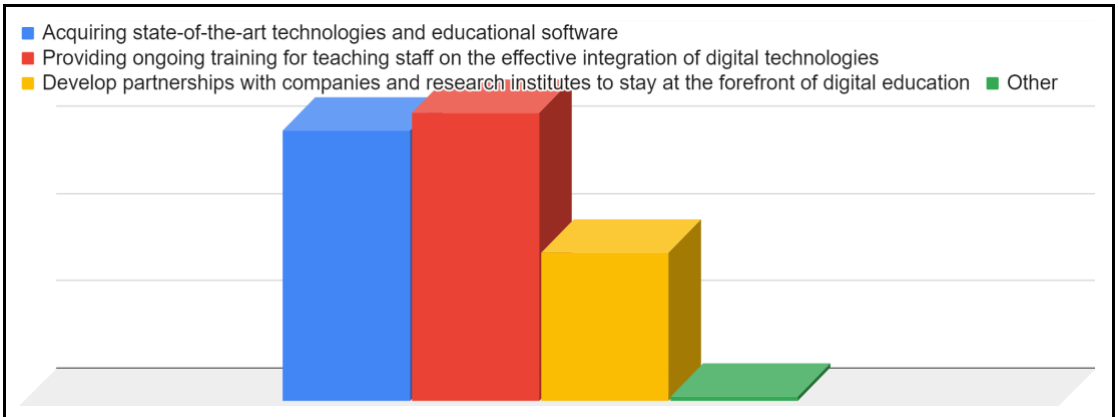

Figure 19 - Priorities for future

Commenting on the results of this survey, it can be noted that teachers of all levels feel the need to improve their training on digital education topics. The perceived competence level for their students is basic, and the

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integration of digital education into teaching is considered insufficient. However, the overall perception of digital education tools is positive, mainly because they are seen as capable of improving student engagement and providing the opportunity for "fun learning."

4. Pedagogical Guidelines (10-12 pages)

The Pedagogical Guidelines outlined in Chapter 4 serve as an essential framework for educators utilizing the Activity Kit. These guidelines aim to enhance the digital and transversal skills of educators, enabling them to deliver interactive and engaging lessons. Through a blend of learning objectives, teaching methodologies, and adaptable activities, educators are equipped to foster a dynamic learning environment. The guidelines emphasize innovative teaching approaches such as Project-Based Learning (PBL), Problem-Based Learning (PBL), Collaborative Learning, and Inquiry-Based Learning (IBL). These methodologies encourage hands-on learning, critical thinking, collaboration, and problem-solving skills crucial for the digital era. Furthermore, the guidelines offer practical advice on tailoring activities to suit various educational contexts, ensuring that all learners, regardless of their background, can benefit from the digital education provided.

4. 1 Learning Objectives

With the uptake and use of the Activity Kit, educators and trainers will be able to:

- Recognise and recall fundamental concepts and terminology related to digital education.
- Retrieve information and comprehend the significance of digital education in both national and EU contexts.
- Interpret the online survey results and understand their implications.
- Recognise the importance of acquiring digital and transversal skills to enhance interactive teaching.
- Implement innovative and context-specific ICT challenges using maker technologies.

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- Relate theoretical knowledge to real-life scenarios in personal life, school life, or community contexts through the ICT challenges.
- Encourage collaborative learning through group activities in the ICT Challenges.
- Integrate digital and transversal skills into teaching methodologies to make teaching more interactive and engaging for learners.
- Utilise guidelines, tips, and example lesson plans to adapt activities to the specific contexts of formal and non-formal education.
- Design learning sessions, using lesson plan examples, that effectively structure ICT courses, considering the progression of difficulty from beginners to advanced levels.
- Assess the effectiveness of the practical ICT activities.
- Gain information and utilise the proposed resources for self-study in Extra Resources.

4.2 Teaching methodologies to foster digital and transversal skills using the activities (ICT challenges)

In the dynamic landscape of digital education, the implementation of diverse and innovative teaching methodologies is fundamental to cultivating a holistic learning experience. The ICT Challenges presented in this Activity Kit provide an opportunity to integrate various approaches that not only enhance technical proficiency but also instil critical thinking, collaboration, and problem-solving skills essential for the digital era.

Project-Based Learning (PBL):

A cornerstone methodology that can be used to implement this Activity Kit is Project-Based Learning (PBL). Through PBL, learners are immersed in hands-on, real-world projects that mirror the challenges encountered in personal or professional settings. Whether it's constructing a robot, crafting a coding application, or designing a 3D-printed model, each ICT challenge unfolds as a comprehensive project. PBL encourages experiential learning, allowing to delve into complex problems, collaborate with peers, and apply

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digital skills in practical scenarios, fostering a deeper understanding of the subject matter.

The primary educational goal of PBL is to cultivate learners' creative capacity, encouraging them to navigate challenging or ill-structured problems, often within small teams. The process involves identifying a problem, devising a solution and potential path, designing and developing a prototype, and refining the solution based on feedback. The instructor's goals can influence the size and scope of the project, ranging from weeks to a single class period. PBL thrives on creativity and collaboration, especially when students work across disciplines and utilize technology as well as when adult learners address real-world issues. The effectiveness of PBL is highlighted, emphasising that projects, regardless of complexity, offer valuable opportunities for learners to make connections across content and practice[16].

Problem-Based Learning (PBL):

Complementing PBL is the Problem-Based Learning approach, where ICT challenges are framed as authentic problems awaiting innovative solutions. In essence, it is a pedagogical approach fostering active learning by immersing learners in meaningful problem-solving experiences.

This methodology prompts learners to analyse, research, and devise practical solutions to real-life scenarios by engaging in collaborative problem-solving, activate prior knowledge, and seek resources for understanding. By addressing challenges connected to personal, school, or community contexts, learners not only refine their digital skills but also cultivate critical thinking and decision-making abilities. The iterative PBL process involves problem analysis, self-directed learning, and reporting, with a tutor guiding and facilitating learners' inquiry paths. Small-group discussions and reflective writing can further consolidate their learning.

[16]Kola, L. (2020). Global mental health and COVID-19. *SAGE Open, 10*(3). https://doi.org/10.1177/2158244020938702

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Problem-Based Learning within the Activity Kit transforms the learning process into a dynamic exploration of real-world challenges[17].

Collaborative Learning:

Collaborative learning stands as a pillar of effective digital education. Within the ICT Challenges, group work is integrated to encourage learners to share insights, pool strengths, and collaboratively address challenges.

Collaborative learning involves two or more learners working together to jointly solve a group task, relying on knowledge sharing to build common ground and collective understanding. The goal of collaborative learning is not just finding a solution but also involves joint knowledge construction and individual learning gains for each group member. The unique knowledge and perspectives of each learner become essential for the collaborative process, emphasising a sense of responsibility for knowledge sharing. This goes beyond mere cooperation, where tasks are divided into independent subtasks, as collaborative learning involves joint knowledge construction, making it more than the sum of its parts[18].

The collaborative approach enhances not only technical skills but also effective communication and teamwork. As learners navigate the complexities of the challenges, they learn to appreciate diverse perspectives, develop interpersonal skills, and prepare for collaborative endeavours in future professional environments.

Research indicates that collaborative learning is highly effective and often surpasses individual learning in terms of academic achievement and attitudes, with meta-analyses supporting its efficacy.

Inquiry-Based Learning:

[17] ScienceDirect. (2016). *Article on ScienceDirect*. https://www.sciencedirect.com/science/article/pii/S2452301116300062#s0010

[18] Kaendler, C., Wiedmann, M., Rummel, N., & Spada, H. (2015). Teacher competencies for the implementation of collaborative learning in the classroom: A framework and research review. *Educational Psychology Review, 27*(3), 505-536. https://doi.org/10.1007/s10648-014-9288-9

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An integral aspect of the teaching methodologies is Inquiry-Based Learning (IBL). Encouraging learners to ask questions, explore possibilities, and conduct independent research during the ICT challenges fosters a sense of curiosity and self-directed learning. IBL empowers learners to take initiative in their education, promoting a deeper understanding of digital concepts and instilling a lifelong passion for learning and discovery.

The IBL process involves learners posing questions, investigating topics, and seeking answers through hands-on experiences. It emphasises learner-driven inquiry, where learners take the lead in defining research questions and conducting investigations. The framework encourages curiosity and engagement, promoting a deeper understanding of subjects and topics. Through iterative cycles of questioning, research, and reflection, learners develop a sense of ownership over their learning, building valuable skills such as information literacy, communication, and analytical thinking[19].

In conclusion, the teaching methodologies embedded in this Activity Kit transcend traditional approaches, aiming to create a dynamic and immersive learning environment. Whether through project-based exploration, collaborative teamwork, or skills-based activities, educators have a rich array of tools to cultivate not only technical proficiency but also the transversal skills essential for success in the 21st century. This multifaceted approach aims to empower learners, equipping them with the skills and mindset needed to thrive in the ever-evolving digital landscape.

For more information it is possible to consult the Training Outline document on the website of the Our Digital Village Kit.

4.3 Guidelines and tips for teachers on how to adapt activities to specific contexts of formal and non-formal education

In adapting ICT-related activities to the unique contexts of formal and non-formal education, educators should carefully consider *th***e diverse needs and characteristics** of their audience. In formal education settings,

[19] Coffman, T. (2017). *Inquiry-based learning: Designing instruction to promote higher level thinking*. Rowman & Littlefield.

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understanding the age group, grade level, and curriculum requirements is essential. Aligning activities with educational standards and creating flexible lesson plans that cater to classroom dynamics and progress is crucial. On the other hand, in non-formal education, recognizing the varied backgrounds, interests, and learning styles of participants is paramount. For adult learners, particularly, it is important to incorporate real-life applications and flexibility, acknowledging their potentially limited time and diverse life experiences. Tailoring activities to engage a broader audience and allowing for adaptability in timeframes is essential.

Contextualizing ICT challenges is key in both settings. In formal education, relating challenges to the subjects being taught and connecting activities to real-world applications within the curriculum is beneficial. Meanwhile, in non-formal education, embedding challenges in contexts relevant to participants' lives, personal experiences, community issues, or future career opportunities enhances engagement and applicability.

Incorporating **interdisciplinary elements** is a strategy that can benefit both formal and non-formal education. In formal settings, integrating ICT challenges with other subjects promotes interdisciplinary learning and emphasises the interconnectedness of digital skills with various fields. In non-formal education, encouraging cross-disciplinary exploration highlights how digital skills can complement diverse interests and potential career paths.

Providing **clear objectives** for each activity is crucial in guiding learners' learning paths, ensuring they understand the skills to be gained and their relevance to their educational journeys. Offering multiple entry points, and accommodating learners of different skill levels with varying difficulty levels, is an **inclusive practice**.

Fostering **collaboration** is an essential aspect of both formal and non-formal education. In formal settings, group activities can enhance teamwork and communication skills within the classroom. In non-formal education, emphasising collaboration in problem-solving and facilitating group activities that encourage knowledge-sharing is beneficial.

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Leveraging **technology accessibility** is crucial to ensure the inclusion of all participants, regardless of their access to devices or the internet. Additionally, promoting **critical thinking** about the applications of ICT skills, discussing ethical considerations, and exploring societal impacts are important components of the educational process.

Connecting activities to **real-world scenarios** is vital in both formal and non-formal education. In formal settings, showcasing real-world applications within various professions emphasises the practical implications of ICT skills. In non-formal education, illustrating how digital skills can be applied in personal, social, and professional contexts enhances the relevance and impact of the activities.

Finally, establishing a **continuous feedback loop** with learners allows educators to assess progress regularly and adapt and improve activities based on their feedback. Facilitating opportunities for learner reflection on their learning experiences encourages them to articulate the skills they have acquired and understand how these skills contribute to their present and future endeavours.

4.3.1 Implementation Tips

In order to create an effective and inclusive learning environment, it is essential to implement a range of strategies that cater to the diverse needs and abilities of learners. This section focuses on key implementation tips to enhance differentiation, inclusion of disadvantaged learners, real-world relevance, critical thinking, assessment techniques, and flexibility in teaching methodologies. By incorporating these strategies, educators can cultivate a supportive atmosphere that fosters growth, curiosity, and skill development among all learners, ultimately preparing them for success in various industries and career paths.

Differentiation:

- Provide additional resources for learners with varying skill levels.
- Encourage peer-assisted learning within diverse groups.

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Inclusion of Disadvantaged Learners:

- Consider diverse learning needs and provide alternative resources or methods.
- Ensure the learning environment is accessible and supportive for all learners.

Real-world Relevance:

- Relate activities to real-life scenarios to enhance engagement and practical understanding.
- Connect digital skills to various industries and potential career paths.

Encourage Critical Thinking:

- Pose open-ended questions to stimulate critical thinking and problem-solving skills.
- Foster a culture of curiosity and exploration.

Assessment:

- Use a mix of formative and summative assessments to evaluate individual and group progress.
- Assess technical skills, teamwork, communication, and creativity.

Flexibility:

- Be adaptable in modifying the lesson based on group dynamics and progress.
- Encourage learners to explore additional challenges or extensions based on their interests.

4.4 Example Lesson Plan on how to structure ICT courses

These general lesson plans can be applied across various digital technology topics, providing a versatile framework for educators. Tailor the content and activities to the specific technology focus chosen for the lesson. Regularly seek learner feedback for continuous improvement.

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4.4.1 Lesson Plan: Exploring Digital Technologies - Beginner Level

Objective:

- Introduce learners to fundamental concepts in digital technologies.
- Develop teamwork, problem-solving, and creative thinking skills.

Materials:

- Digital technologies kits (specific to the chosen topic, e.g., coding, microcontrollers, 3D modelling)
- Laptops or tablets with relevant software installed
- Whiteboard and markers
- Printed guides for basic concepts and skills

Duration:

- 135 minutes

Introduction (20 minutes):

1. Ice Breaker (10 minutes): Engage learners with a brief icebreaker activity to create a positive learning environment. Example:

   "Describe Yourself with an Emoji"

   Introduce yourself by using (or drawing) an emoji. Then explain why you selected this emoji and why. For additional fun, you can ask students to give their emoji a name and even use it as it as an avatar for themselves in your course[20].
2. Introduction to Digital Technologies (10 minutes): Discuss the importance of digital skills in various fields, emphasising real-world applications.

Main Activity - Hands-on Challenge (95 minutes):

1. Formation of Groups (5 minutes): Divide the class into small groups, ensuring a mix of skills and fostering collaboration.

[20] Nurse-Clarke, N. (n.d.). *Ice-breaker Tuesday: Describe yourself with an emoji*. Retrieved from https://www.natashanurseclarke.com/blog/ice-breaker-tuesday-describe-yourself-with-an-emoji

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2. Kit Orientation (10 minutes): Provide a brief overview of the digital technologies kits, explaining essential components and their functions.
3. Basic Skills Tutorial (25 minutes): Conduct a short tutorial on fundamental skills, such as coding basics, microcontroller connections, 3D modelling principles, etc. Please refer to Module 3 of Training Outline for the theoretical part of ICT topics.
4. Challenge Introduction (5 minutes): Present a challenge related to the chosen topic, linking it to a real-life scenario or problem-solving context.
5. Hands-on Activity – ICT challenge (50 minutes): Allow groups to work together, applying the skills learned to solve the challenge using the provided kits and technology. Please refer to Module 4 of Training Outline for the practical implementation of activities.

Closing and Reflection (20 minutes):

1. Testing and Presentation (10 minutes): Each group presents their solution, demonstrating how they applied the digital skills to address the challenge.
2. Reflection and Discussion (10 minutes): Lead a class discussion on the learning process, challenges faced, and the relevance of digital skills in the presented scenario.

4.4.2 Lesson Plan: Advancing Digital Technologies - Intermediate Level

Objective:

- Expand learners' knowledge and skills in digital technologies.
- Encourage independent problem-solving and critical thinking.

Materials:

- Digital technologies kits (e.g., Robotics, Coding)
- Laptops or tablets with relevant software installed
- Advanced programming tools, if applicable
- Whiteboard and markers

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- Printed guides for intermediate-level concepts and skills

Duration:

- 135 minutes

Introduction (20 minutes):

1. Ice Breaker (10 minutes): Engage learners with a brief icebreaker activity to create a positive learning environment. Example:

   "Find Something In Common"
   Learners are divided into small breakout rooms and given a few minutes to discuss and find something all members have in common. Afterward, each group shares their commonality with the whole class. This encourages conversation and helps participants discover shared interests.
2. Review of Basic Concepts (10 minutes): Briefly revisit foundational concepts from the beginner level. Discuss the importance of building on these skills.

Main Activity - Advanced Hands-on Challenge (95 minutes):

1. Formation of Groups (5 minutes): Divide the class into small groups, ensuring a mix of skills and fostering collaboration.
2. Kit Orientation (10 minutes): Provide a brief overview of the advanced digital technologies kits, highlighting new components and functions.
3. Intermediate Skills Tutorial (25 minutes): Conduct a tutorial on more complex skills, building upon the basics. Please refer to Module 3 of Training Outline for the theoretical part of ICT topics.
4. Challenge Introduction (5 minutes): Present an advanced challenge related to the chosen technology, linking it to a real-life scenario or problem-solving context.
5. Hands-on Activity – ICT Challenge (50 minutes): Allow groups to work on the challenge, applying the intermediate-level skills learned. Please refer to Module 4 of Training Outline for the practical implementation of activities.

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Closing and Reflection (20 minutes):

1. Testing and Presentation (10 minutes): Each group presents their solution, demonstrating how they applied the advanced digital skills to address the challenge.
2. Reflection and Discussion (10 minutes): Facilitate a class discussion on the learning process, challenges faced, and the progression from beginner to intermediate levels.

2.4.3 Lesson Plan: Mastering Digital Technologies - Advanced Level

Objective:

- Develop advanced proficiency in digital technologies.
- Foster independent exploration and innovation.

Materials:

- Advanced digital technologies kits
- Specialised software and tools
- Advanced programming languages, if applicable
- Whiteboard and markers
- Printed guides for advanced concepts and skills

Duration:

- 170 minutes

Introduction (20 minutes):

1. Ice Breaker (5 minutes): Engage learners with a brief icebreaker activity to create a positive learning environment. Example:

   "Two truths and a lie"
   Each participant thinks of two true facts about themselves and one believable lie. They take turns sharing their three statements, and the rest of the class tries to guess which one is the lie. This game is great for laughs and learning interesting facts about each other.

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2. Review of Intermediate Concepts (15 minutes): Briefly review key concepts covered at the intermediate level. Discuss the importance of building advanced skills.

Main Activity - Mastering Hands-on Challenge (110 minutes):

1. Formation of Groups (5 minutes): Divide the class into small groups, ensuring a mix of skills and fostering collaboration.
2. Kit Orientation (10 minutes): Provide a brief overview of the advanced digital technologies kits, emphasising new features and functionalities.
3. Advanced Skills Workshop (35 minutes): Conduct an intensive workshop on advanced skills, exploring cutting-edge features and tools. Please refer to Module 3 of Training Outline for the theoretical part of ICT topics.
4. Challenge Introduction (10 minutes): Present a challenging project related to the chosen technology, encouraging independent exploration and innovation.
5. Hands-on Activity – ICT Challenge (50 minutes): Allow groups to work on the challenge, applying advanced skills and exploring innovative solutions. Please refer to Module 4 of Training Outline for the practical implementation of activities.

Closing and Reflection (20 minutes):

1. Testing and Presentation (10 minutes): Each group presents their project, showcasing advanced applications of digital technologies.
2. Reflection and Discussion (10 minutes): Facilitate a reflective discussion on the individual projects and potential future applications. Discuss the importance of continuous learning in the rapidly evolving field of digital technologies.

4.5 Learning support

Since the challenges are divided into levels, the advanced ones are clearly designed for people who already have some skills and experience with the proposed technologies.

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We have included some paragraphs in the “Training Outline” document that explain the different technologies and can help the participants of the challenges follow a learning path to be able to complete even the more difficult ones.

- To explore “3D Modelling and Printing”
- To explore “Coding”
- To explore “Robotics”
- To explore “Microcontrollers”
- To explore “Web Development”

4.6 Real World Application: “Apply to your world”

As explained above, it is always useful and effective when the proposed activities are directly connected — or at least easy to relate — to real-world applications around us. The challenges below were all designed following this idea. However, for some of the challenges that involve the use of microcontrollers, we include in this paragraph some tips and examples to make the connection with the real world even more clear.

Challenge 4.1.3 – “Let's create a flashing warning light signal”

A possible real-world application is creating a light pattern for a small Christmas tree. Several LED lights can be controlled by Arduino using the same logic shown in Challenge 4.1.3, but instead of placing the LEDs on a breadboard only, they can be fixed on a cardboard shape of a Christmas tree, which will light up with the programmed light pattern.

Challenge 4.1.4 – “How to open and close an electrical circuit with a button?”

A practical example can be made by placing the push button switch inside the door of a locker (real or as a scale model made with cardboard, for example). In this way, the LED connected to the output pin will turn on when the door is opened — just like the light inside a refrigerator.

Challenge 4.3.1 – “How can adjustable lighting be created?”

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A practical application could be building a small model of a room. You can use a small cardboard box with three walls and a ceiling, and place the LED (controlled by a dimmer) through a hole in the ceiling. This helps students understand how the light in a room can be dimmed for visual comfort.

Challenge 4.3.2 – "Simulating Windshield Wiper Movement with Microcontrollers!"

Since this challenge simulates a windshield wiper, the result can be more realistic by building a simple model. Use a piece of transparent plastic as the windshield and attach the servo motor with a cardboard strip as the wiper.

Challenge 4.3.3 – "Alarm Management for High Temperatures"

A real-world example can be done by using the same circuit proposed in the challenge to compare temperature changes in a room. Place the circuit in a sunny area or in the shade, and you can use the alarm to detect when it gets too hot. Or, with the opposite logic, use it to detect when it becomes too cold by moving it away from a heat source, like a heater.

4.7 Tips in Case of No Devices: "Unplugged Activities"

Since these are ICT activities, we have to start from the idea that having the right technological devices is often very important.

However, it is possible to do activities based on the same principles that help develop computational thinking in a similar way, but in an "unplugged" format — that means without using devices like tablets, robots, etc.

These activities can be done using just paper, markers, masking tape,and simple everyday materials.

4.7.1 Unplugged Activities – 3D Modeling and 3D Printing

For 3D modeling, these are well-known school activities where students create 3D shapes (from simple ones like cubes or cylinders to more complex models) using cardboard templates. The shapes are cut, folded, and then closed in 3D using glue, tape, pins, or other simple tools.

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For 3D printing, unplugged activities can help students understand how 3D printers work by using hot glue guns. The glue is added in layers, just like a 3D printer extrudes plastic to build objects layer by layer.

Another useful unplugged activity is building 3D shapes by stacking layers of cardboard, similar to how slicing software works. For example, stacking identical round pieces creates a cylinder; stacking rectangles makes a box shape; stacking discs that grow and shrink in size can form a sphere-like shape.

4.7.2 Unplugged Activities – Coding and Robotics

Grid movement instructions:

Using the logic of movement commands (like arrows), students can do unplugged activities by creating grids with tape on the floor or using the tiles as grid squares. Real people play the role of sprites or characters, and follow written or spoken instructions, like algorithms, to reach target positions.

Pixel art:

Great for younger students, pixel art activities involve coloring grids by following coded instructions (like coordinates or sequences). This simulates how pixels work on a screen and helps develop logic, focus, and creativity.

(For example: https://www.zaplycode.it)

Simulated robotics:

These activities are not fully unplugged because they use tablets or computers, but they allow students to start learning robotics even without real robots. Online resources let you code robots and see them move in web-based simulators.

(For example: https://beebot.terrapinlogo.com/ or https://code.irobot.com/#/)

4.7.3 Unplugged activities for microcontrollers

Like robotics, it is possible to do partially unplugged activities using tablets or computers instead of real devices like Arduino or Micro:bit.

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Students can build and program virtual electronic circuits with microcontrollers using online simulators.

For example:

https://www.tinkercad.com/dashboard/designs/circuits

https://makecode.microbit.org/

5. ICT Challenges

5.1 3D modelling and printing: Beginners, Intermediate, Advanced

5.2 Coding: Beginners, Intermediate, Advanced

5.3 Robotics: Beginners, Intermediate, Advanced

5.4 Microcontrollers: Beginners, Intermediate, Advanced

5.5 Web development: Beginners, Intermediate, Advanced

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Beginner Level

ICT CHALLENGES

1.1 3D modelling and printing

1.1.1 How can I personalise my stuff (key bunch/backpack)?

Learning Support | Beginner level lesson plan example

Challenge description:

Have you ever found yourself unable to distinguish your belongings, such as a bunch of keys, a small backpack, or other everyday items, from those of others? How could 3D modelling and 3D printing be utilised to create a small object that solves this issue?

Getting Started Guide

This challenge encourages a practical, beginner-level project in 3D modelling and 3D printing. Participants are tasked with tackling the challenge by creating a model, exporting it in STL format, performing slicing, and ultimately using the 3D printer. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min (not including 3D printing time for multiple objects)

Learning objectives:

- Creating a simple 3D model based on a practical need;
- Exporting the 3D model in the correct format;
- Setting-up the slicing software;
- Initiating the 3D printing process using a filament 3D printer.

Material required:

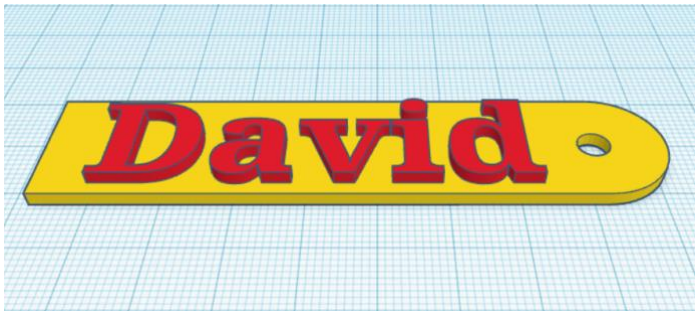
- Computer with a mouse and internet connection;
- 3D printer.
- Filament for 3D printer.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- adding or removing details in 3D modelling;
- entirely or partially delegating the slicing and 3D printing phase to the trainer/tutor.

Hint for the solution:



Participants could proceed with the modelling of a nameplate with a personalised inscription and the possibility or create copies and variations.

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Beginner Level

ICT CHALLENGES

1.1 3D modelling and printing

1.1.2 How can I promote my city or school or business?

Learning Support | Beginner level lesson plan example

Challenge description:

You need to promote your city (a monument, a food item, a recurring event, etc.) or your school (considering activities that distinguish it from others) or your family business. What type of 3D-printed gadget would you model? A souvenir? A small game? A logo?

Getting Started Guide

This challenge encourages a practical, beginner-level project in 3D modelling and 3D printing. Participants are tasked with tackling the challenge by creating a model, exporting it in STL format, performing slicing, and ultimately using the 3D printer. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

(not including 3D printing time for multiple objects)

Learning objectives:

- Acquiring in-depth knowledge about the city, school, or family business being promoted, including details about monuments, local cuisine, recurring events, and distinctive activities.
- Learning to translate promotional concepts into attractive 3D objects, such as souvenirs, small games, or logos, using 3D modelling software.
- If the challenge involves a team, promoting collaboration among team members to integrate diverse ideas and skills into the creative process.

Material required:

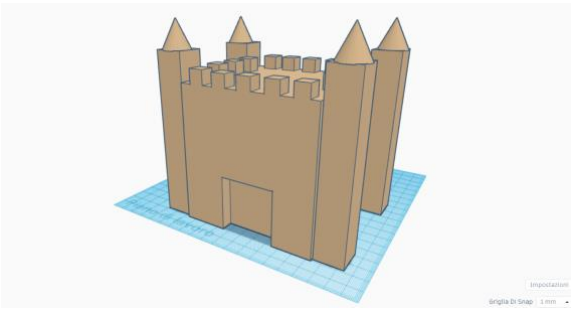
- Computer with a mouse and internet connection;
- 3D printer (optional).
- Filament for 3D printer (optional).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- adding or removing details in 3D modelling;
- entirely or partially delegating the slicing and 3D printing phase to the trainer/tutor.

Hint for the solution:



Participants could try to view photos of some monuments in their city and stylize their forms in 3D, each creating their own personalised version.

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Beginner Level

ICT CHALLENGES

1.1 3D modelling and printing

1.1.3 How can I help my grandparents take their pills correctly?

Learning Support | Beginner level lesson plan example

Challenge description:

Often, the elderly, such as your grandparents, have to take many pills: sometimes they forget, other times they mix them up. How could you lend them a hand by coming up with and designing a 3D-printable object?

Getting Started Guide

This challenge encourages a practical, beginner-level project in 3D modelling and 3D printing. Participants are tasked with tackling the challenge by creating a model, exporting it in STL format, performing slicing, and ultimately using the 3D printer. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

(not including 3D printing time for multiple objects)

Learning objectives:

- Encouraging creative thinking to devise a 3D-printable object that addresses the specific needs of the elderly in organising and managing their medications.
- Applying user-centred design principles to ensure that the 3D-printed object is practical, user-friendly, and tailored to the needs and abilities of the elderly.
- Learning to create prototypes of the 3D-printed object and iterating on the design based on user feedback and testing.

Material required:

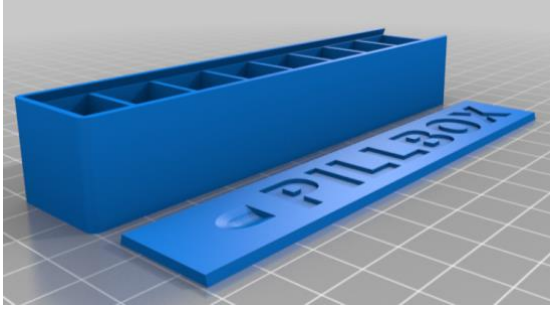
- Computer with a mouse and internet connection;
- 3D printer (optional).
- Filament for 3D printer (optional).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- adding or removing details in 3D modelling;
- entirely or partially delegating the slicing and 3D printing phase to the trainer/tutor.

Hint for the solution:



Participants could model and 3D print a "smart pill dispenser". This object could be designed with separate compartments for each day of the week. The use of distinct colours, enlarged text, could further facilitate the device's usability for the elderly.

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Beginner Level

ICT CHALLENGES

1.1 3D modelling and printing

1.1.4 What items can I sell at a Christmas bazaar to raise funds for the school?

Learning Support | Beginner level lesson plan example

Challenge description:

Your school needs to fundraise money for new equipment and wants to find innovative ideas for a Christmas bazaar. Think of objects to model and then 3D print that could make a nice Christmas gift.

Getting Started Guide

This challenge encourages a practical, beginner-level project in 3D modelling and 3D printing. Participants are tasked with tackling the challenge by creating a model, exporting it in STL format, performing slicing, and ultimately using the 3D printer. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min (not including 3D printing time for multiple objects)

Learning objectives:

- Stimulating creativity in generating ideas for 3D printable objects that could make nice Christmas gifts.
- Thinking about how the 3D object can be produced on a larger scale in view of the school's fundraising event.
- Learning to assess the costs associated with the production of 3D objects compared to the expected gain from sales.
- Creating a marketing strategy to promote 3D objects as attractive Christmas gifts.

Material required:

- Computer with a mouse and internet connection;
- 3D printer (optional).
- Filament for 3D printer (optional).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- adding or removing details in 3D modelling;
- entirely or partially delegating the slicing and 3D printing phase to the trainer/tutor.

Hint for the solution:

Participants could create Christmas tree decorations, or jewellery and small accessories for school.

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1.2 3D modelling and printing

1.2.1 How can I keep my phone in the same position while taking photos for a time-lapse video?

Learning Support | Intermediate level lesson plan example

Challenge description:

For a school project, you need to create a time-lapse video by taking many photos of objects that are gradually moved across the scene. The phone must always maintain the same position and inclination. What can be 3D printed to hold the phone in a precise position?

Getting Started Guide

This challenge encourages a practical, intermediate-level project in 3D modelling and 3D printing. Participants are tasked with tackling the challenge by creating a model, exporting it in STL format, performing slicing, and ultimately using the 3D printer. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

(not including 3D printing time for multiple objects)

Learning objectives:

- Thinking about the ergonomic aspects of the holder to ensure it is comfortable to use and keeps the phone in a stable position.
- If the challenge involves a team, promoting collaboration among team members and sharing skills in the areas of design and 3D printing.

Material required:

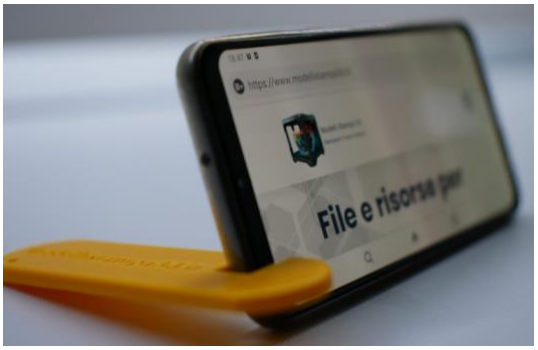
- Computer with a mouse and internet connection;
- 3D printer (optional).
- Filament for 3D printer (optional).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- adding or removing details in 3D modelling;
- entirely or partially delegating the slicing and 3D printing phase to the trainer/tutor.

Hint for the solution:



Participants could think of very simple solutions, such as an object composed of a single element with a slot to house the phone so that it stays in the correct position.

1.2 3D modelling and printing

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Intermediate Level

ICT CHALLENGES

1.2.2 How can I keep the cables of all the devices on my desk organised?

Learning Support | Intermediate level lesson plan example

Challenge description:

On the desk, we can find a computer, speakers, a printer, and various other devices whose cables are often messy or tangled. Try to think of a 3D-printed object that can keep the cables of all the devices on the desk organised.

Getting Started Guide

This challenge encourages a practical, intermediate-level project in 3D modelling and 3D printing. Participants are tasked with tackling the challenge by creating a model, exporting it in STL format, performing slicing, and ultimately using the 3D printer. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

(not including 3D printing time for multiple objects)

Learning objectives:

- Devise a practical and functional solution for organising cables, considering the sizes and arrangement of devices on the desk.
- Consider the aesthetic aspects of the 3D-printed object, taking into account the context of the desk and its visibility.
- Create prototypes of the 3D-printed object and iterate the design based on feedback and practical needs.

Material required:

- Computer with a mouse and internet connection;
- 3D printer (optional).
- Filament for 3D printer (optional).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- adding or removing details in 3D modelling;
- entirely or partially delegating the slicing and 3D printing phase to the trainer/tutor.

Hint for the solution:

Participants could model and 3D print a cable holder through which all the cables can pass, taking into account the number, type, and thickness of each individual cable.

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Intermediate Level

ICT CHALLENGES

1.2 3D modelling and printing

1.2.3 How can I keep my desk organised?

Learning Support | Intermediate level lesson plan example

Challenge description:

You need to solve the problem of a very cluttered desk with scattered small items: staples, pencils, pens, pencil sharpeners, scissors, glue, post-its, rulers, highlighters, etc. Try to come up with and 3D print an organiser that can keep everything tidy.

Getting Started Guide

This challenge encourages a practical, intermediate-level project in 3D modelling and 3D printing. Participants are tasked with tackling the challenge by creating a model, exporting it in STL format, performing slicing, and ultimately using the 3D printer. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

(not including 3D printing time for multiple objects)

Learning objectives:

- Consider the aesthetic aspects of the 3D-printed organiser, taking into account functionality and visual appearance.
- Devise a practical and functional solution for organising scattered items on the desk, considering the size and type of items.

Material required:

- Computer with a mouse and internet connection;
- 3D printer (optional).
- Filament for 3D printer (optional).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- adding or removing details in 3D modelling;
- entirely or partially delegating the slicing and 3D printing phase to the trainer/tutor.

Hint for the solution:

Participants could consider a single container or choose many small, distinct, modular, and interlocking containers.

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Advanced Level

ICT CHALLENGES

1.3 3D modelling and printing

1.3.1 How can I throw away the scraps of paper without getting up from my school desk?

Learning Support | Advanced level lesson plan example

Challenge description:

You are at school and need to throw away some scraps of paper, but the teacher doesn't want students to get up during lessons. Try to imagine something that could solve this problem without taking up too much space in the desk.

Getting Started Guide

This challenge encourages a practical, advanced-level project in 3D modelling and 3D printing. Participants are tasked with tackling the challenge by creating a model, exporting it in STL format, performing slicing, and ultimately using the 3D printer. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

(not including 3D printing time for multiple objects)

Learning objectives:

- Thinking in terms of the device's functionality, ensuring that it is easy to use and effectively serves its purpose.
- Creating prototypes of the 3D-printed device and iterating the design based on feedback and practical needs.
- Thinking about how the device could be made in a sustainable and environmentally friendly manner, such as through the use of recyclable materials.

Material required:

- Computer with a mouse and internet connection;
- 3D printer (optional).
- Filament for 3D printer (optional).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- adding or removing details in 3D modelling;
- entirely or partially delegating the slicing and 3D printing phase to the trainer/tutor.

Hint for the solution:

Participants could build a container with a hook that can hang on the desk, or just the hook and adapt existing commercially available containers.

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Advanced Level

ICT CHALLENGES

1.3 3D modelling and printing

1.3.2 How can I help my maths teacher explain the concept of the Cartesian Space to my classmates?

Learning Support | Advanced level lesson plan example

Challenge description:

At school, the Cartesian plane with the x and y axes is studied very well. However, when the third axis, z, is introduced, things become more complicated. Think of an object to draw and then 3D print that can help the class understand how the x, y, and z axes work.

Getting Started Guide

This challenge encourages a practical, advanced-level project in 3D modelling and 3D printing. Participants are tasked with tackling the challenge by creating a model, exporting it in STL format, performing slicing, and ultimately using the 3D printer. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

(not including 3D printing time for multiple objects)

Learning objectives:

- Deepening students' understanding of three-dimensional axes (x, y, z) and how they interact in three-dimensional space.
- Applying the theory of three-dimensional axes through the practical use of the 3D Cartesian plane in the design and 3D printing process.
- Connect the understanding of three-dimensional axes with mathematical concepts and technical skills acquired through 3D modelling and printing.

Material required:

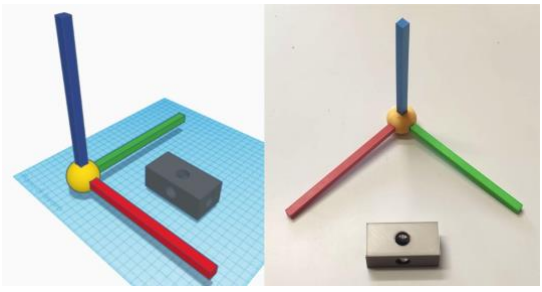
- Computer with a mouse and internet connection;
- 3D printer (optional).
- Filament for 3D printer (optional).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- adding or removing details in 3D modelling;
- entirely or partially delegating the slicing and 3D printing phase to the trainer/tutor.

Hint for the solution:



Participants could think about how to faithfully represent the Cartesian axes and the possible rotations or movements around them for any object.

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Advanced Level

ICT CHALLENGES

1.3 3D modelling and printing

1.3.3 How can I avoid throwing away objects that have broken parts?

Learning Support | Advanced level lesson plan example

Challenge description:

A piece of an object breaks (for example a piece of the phone case, pen holder, bike...). Recovery, recycling and reuse of an object: I can model and 3D print the missing part by taking measurements of the broken piece to be replaced using a ruler or calliper and faithfully reproducing a replica.

Getting Started Guide

This challenge encourages a practical, advanced-level project in 3D modelling and 3D printing. Participants are tasked with tackling the challenge by creating a model, exporting it in STL format, performing slicing, and ultimately using the 3D printer. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

(not including 3D printing time for multiple objects)

Learning objectives:

- Deepening students' understanding of the concept of recovery, recycling, and reuse of objects through 3D modelling and printing.
- Learning to take accurate measurements using tools such as a ruler or caliper to obtain precise data for 3D modelling.
- Raising students' awareness of sustainability through the recovery and recycling of objects, reducing waste production.

Material required:

- Computer with a mouse and internet connection;
- 3D printer (optional).
- Filament for 3D printer (optional).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- adding or removing details in 3D modelling;
- entirely or partially delegating the slicing and 3D printing phase to the trainer/tutor.

Hint for the solution:

Participants could see what is broken in the classroom and consider making an accurate replica or creating a new object to replace the old one. For example: if a hook for backpacks or jackets is broken, they can create something that can restore its original function.

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Beginner Level

ICT CHALLENGES

2.1 Coding

2.1.1 How can I study the customs and traditions of the world?

Learning Support | Beginner level lesson plan example

Challenge description:

In school, we are studying the customs and traditions of various countries around the world. In Japan, for example, when two people meet, in addition to greeting each other, they bow. How can I narrate all of this using Scratch?

Getting Started Guide

This challenge promotes a practical, beginner-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming interactive animations, storytelling, quizzes, or small video games using one of the world's most famous free online coding platforms: "Scratch." Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Acquire familiarity with fundamental programming concepts, such as command sequences, loops, conditions, and variables.
- Experience the ability to collaborate with other participants through shared projects.
- Develop skills in creatively solving problems by tackling specific challenges (problem solving).
- Encourage students' creativity in devising visual and interactive solutions to narrate cultural customs through coding with Scratch.

Material required:

- Computer and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as offering additional time and providing extra resources.

Hint for the solution:

Could you see if there are any Scratch characters that, by changing their costume, appear to bow, and try to make the two characters perform these movements simply using the 'looks' blocks. Remember to use waits to coordinate the sequence of movements effectively.

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Beginner Level

ICT CHALLENGES

2.1 Coding

2.1.2 How can I study the cycle of seasons in a fun way?

Learning Support | Beginner level lesson plan example

Challenge description:

At school, my classmates and I are studying the cycle of seasons: spring-summer-fall-winter. How can I create an interactive lesson that describes what happens during each season in a fun and engaging way?

Getting Started Guide

This challenge promotes a practical, beginner-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming interactive animations, storytelling, quizzes, or small video games using one of the world's most famous free online coding platforms: "Scratch." Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Encourage students' creativity in devising original visual and interactive solutions to describe the distinctive features of each season.
- Promote digital literacy through learning programming skills and the creative use of technology to explore scientific concepts.

Material required:

- Computer and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as offering additional time and providing extra resources.

Hint for the solution:

Create a Scratch project that interactively represents the cycle of seasons. Use the character to illustrate the effects of different seasons on the background. For example, in the spring-summer-fall-winter cycle, the character could wear appropriate clothing, and the background could change to reflect the climate of each season. Use motion and costume change blocks to move the character and alter its appearance based on the season. Add interactive features, such as the ability for the user to click to advance to the next season or view information about the current season. Provide educational information about typical changes in nature during each season. For instance, describe what happens to trees, plants, and animals during each time of the year.

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Beginner Level

ICT CHALLENGES

2.1 Coding

2.1.3 How can I humorously share with my classmates what I did during the holidays?

Learning Support | Beginner level lesson plan example

Challenge description:

My classmates want to see what I did during the summer holidays or the Christmas holidays, but I haven't made any videos. I can create an animated story using my photos for both characters and backgrounds, adding dialogues and music.

Getting Started Guide

This challenge promotes a practical, beginner-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming interactive animations, storytelling, quizzes, or small video games using one of the world's most famous free online coding platforms: "Scratch." Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Learning to incorporate meaningful dialogues into the animated story, developing writing and narrative expression skills.
- Integrating music into the animated story to enhance the user experience, understanding how the soundtrack can influence the atmosphere of the narration.
- Fostering awareness of responsible digital sharing, understanding the importance of respecting privacy and ethics in using personal material.

Material required:

- Computer and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as offering additional time and providing extra resources.

Hint for the solution:

Use Scratch to create an animated story using your photos as characters and backgrounds. Add dialogues and music to make your narration engaging. Take inspiration from storytelling projects already created by other users that you can find in the Scratch gallery. This will help you understand which blocks to use and customise for your own story.

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Beginner Level

ICT CHALLENGES

2.1 Coding

2.1.4 How can I create an art lesson?

Learning Support | Beginner level lesson plan example

Challenge description:

At school, we need to prepare an art presentation to talk about the world's most famous artworks: how can I do it in a fun and engaging way with Scratch?

Getting Started Guide

This challenge promotes a practical, beginner-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming interactive animations, storytelling, quizzes, or small video games using one of the world's most famous free online coding platforms: "Scratch." Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Deepen students' understanding of the world's most famous artworks by conducting research and selecting significant pieces.
- Fostering awareness of art history, connecting presented artworks to historical and cultural contexts.
- Encourage collaboration among students to share ideas, skills, and resources in creating the presentation.

Material required:

- Computer and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as offering additional time and providing extra resources.

Hint for the solution:

You might consider inserting two characters who travel around various museums worldwide where the most famous artworks are housed. As the story progresses, the characters find themselves with a different artwork as the background, and they comment on it, narrating its most representative details. Use the 'looks' and 'events' blocks to transition from one artwork to another. If you want, you can have the characters ask questions about the artworks that your classmates will have to answer.

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Intermediate Level

ICT CHALLENGES
2.2 Coding

2.2.1 How can I use my computer as a graphic tablet to draw freehand?

Learning Support | Intermediate level lesson plan example

Challenge description:

I'm in the computer lab, and I left my notebook and pencil in the classroom. I absolutely need to explain to my friends how to get to my house for my birthday party by drawing a sketch. How can I create a sort of graphic tablet with Scratch?

Getting Started Guide

This challenge promotes a practical, intermediate-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming interactive animations, storytelling, quizzes, or small video games using one of the world's most famous free online coding platforms: "Scratch." Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Fostering an understanding of programming logic, such as through control loops and conditions, to manage the flow of the application.
- Tackling the challenge of creating a virtual graphic tablet, developing problem-solving skills in implementing desired features.

Material required:

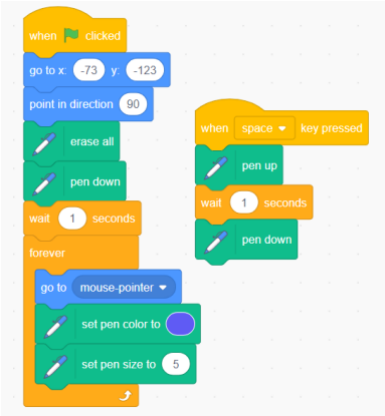
- Computer and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as offering additional time and providing extra resources.

Hint for the solution:



You could use the 'pencil' sprite and make it write on a sheet of paper (you can use the graph paper background). To make your pencil write, you need to add a new block group that is not present among the default blocks, by adding the 'pen' extension. You can choose the color and thickness of your pencil and make it move following the mouse cursor. Remember to use waits to manage the movements effectively.

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Intermediate Level

ICT CHALLENGES
2.2 Coding

2.2.2 How can I learn how waste separation works in my city?

Learning Support | Intermediate level lesson plan example

Challenge description:

In my city, the rules for waste separation have recently changed, and citizens haven't fully understood how it works yet. How can I explain in a simple and fun way which bin to use for a particular item, by creating a small interactive game with Scratch?

Getting Started Guide

This challenge promotes a practical, intermediate-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming interactive animations, storytelling, quizzes, or small video games using one of the world's most famous free online coding platforms: "Scratch." Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Incorporating educational elements into the game, providing explanations or hints when users make incorrect choices.
- Fostering digital literacy, encouraging an understanding of technology as an educational and informational tool.

Material required:

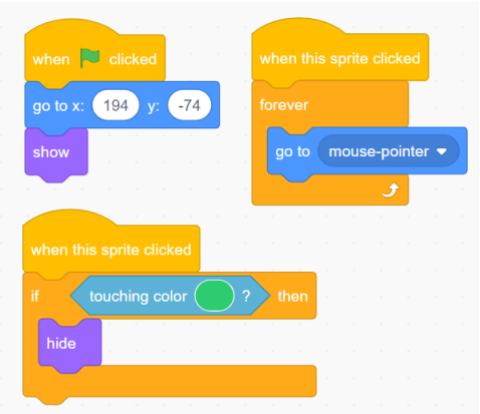
- Computer and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as offering additional time and providing extra resources.

Hint for the solution:



You can create a code using a custom background where various containers for organic waste, glass, paper, etc., are drawn. Then, you can choose at least one sprite for each container: an apple, a milk carton, and a glass. You need to ensure that each sprite disappears when it touches the correct container, which you can choose by associating a specific colour; otherwise, it doesn't disappear. Additionally, you need to ensure that each sprite, at the start of the animation, is positioned at a specific point on the stage and is connected to the mouse pointer.

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Intermediate Level

ICT CHALLENGES
2.2 Coding
2.2.3 How can I study regular polygons without getting bored?

Learning Support | Intermediate level lesson plan example

Challenge description:

Often, studying mathematics and geometry can be complicated and boring. However, if I turn a maths lesson into a game, it will be more enjoyable, and I will definitely learn more. How can I code something that helps me understand the number of sides regular polygons have? Like a triangle, square, pentagon, hexagon, octagon, decagon, etc.

Getting Started Guide

This challenge promotes a practical, intermediate-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming interactive animations, storytelling, quizzes, or small video games using one of the world's most famous free online coding platforms: "Scratch." Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Incorporating educational elements into the game, such as detailed explanations about polygons and their characteristics.
- Fostering awareness of mathematics through the interactive approach of the game, making the learning process more engaging.

Material required:

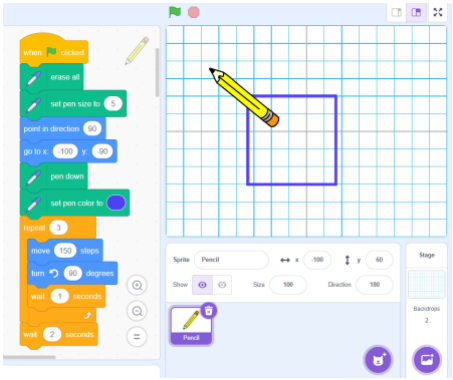
- Computer and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as offering additional time and providing extra resources.

Hint for the solution:



You can use the 'pen' blocks found in additional extensions to help a pencil draw polygons. To draw a square, for example, you can move the pencil a certain number of steps and then rotate it by 90 degrees. Repeat this process four times (since a square has four sides) using the 'repeat' block found in the 'control' category. For each polygon, you'll need to change the number of sides and the degrees by which the pencil should rotate. In the same code, you can repeat the same block group to have the pencil draw one polygon after another.

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Advanced Level

ICT CHALLENGES
2.3 Coding
2.3.1 How can I create a countdown timer?

Learning Support | Advanced level lesson plan example

Challenge description:

During the science class, all students must present their home-prepared projects, but time is limited, and the teacher has decided to give each student two minutes. How can I help the teacher create a kind of timer that counts 120 seconds with Scratch?

Getting Started Guide

This challenge promotes a practical, advanced-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming interactive animations, storytelling, quizzes, or small video games using one of the world's most famous free online coding platforms: "Scratch." Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Learning how to manage time through programming, ensuring precise and reliable counting.
- Exploring advanced functions of Scratch, such as the use of variables, loops, and conditions, to enhance programming skills.
- Fostering awareness of the importance of adhering to presentation times in academic contexts.

Material required:

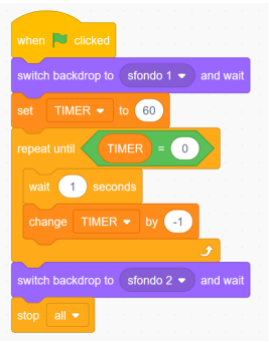
- Computer and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as offering additional time and providing extra resources.

Hint for the solution:



You can use the default character or upload a new character that represents the timer. Create a new variable called “timer” and set it to 120 seconds. In the 'Blocks' section, use control blocks to create a script that counts up to 120 seconds. You can use the 'Wait 1 seconds' block inside a loop to track the time. Add graphical elements to display the time elapsed during the countdown. For example, you can change the character's costume or show the time on a background. Make sure you have two backdrops for your stage (The main background for your game and a Game Over background).

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Advanced Level

ICT CHALLENGES
2.3 Coding
2.3.2 How can I create a quiz?

Learning Support | Advanced level lesson plan example

Challenge description:

The geography teacher needs to quiz the students but doesn't want to scare or bore them. How can I help the teacher prepare a quiz with various questions using Scratch?

Getting Started Guide

This challenge promotes a practical, advanced-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming interactive animations, storytelling, quizzes, or small video games using one of the world's most famous free online coding platforms: "Scratch." Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Fostering a playful approach to learning geography through the quiz, making the experience more engaging.
- Developing critical reflection skills, evaluating the effectiveness of the quiz in the context of geography education.

Material required:

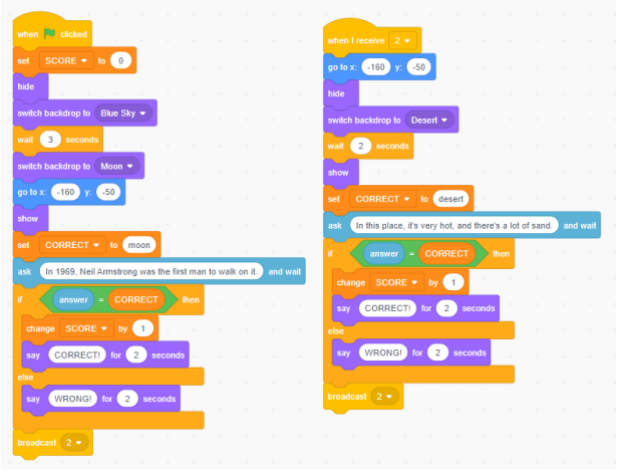
- Computer and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as offering additional time and providing extra resources.

Hint for the solution:



Can you create the variable 'correct' to set the correct answer? Use sensor blocks to set up the question. With the 'if-then' control block, you can determine what the correct and incorrect answers are. Additionally, by creating another variable called 'score,' you can score a point for each correct answer.

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Advanced Level

ICT CHALLENGES
2.3 Coding

2.3.3 How can I learn the meaning of words in many different languages?

Learning Support | Advanced level lesson plan example

Challenge description:

Languages are not easy for everyone, and sometimes it is necessary to use a translator that can help us with the meaning of words. How can I create a real translator with Scratch?

Getting Started Guide

This challenge promotes a practical, advanced-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming interactive animations, storytelling, quizzes, or small video games using one of the world's most famous free online coding platforms: "Scratch." Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Fostering awareness of the ethical use of the translator, understanding its limitations and promoting language awareness.
- Developing critical reflection skills, evaluating the accuracy and effectiveness of translations offered by the application.
- Encouraging a playful approach to language learning through the translator, making the experience more engaging.

Material required:

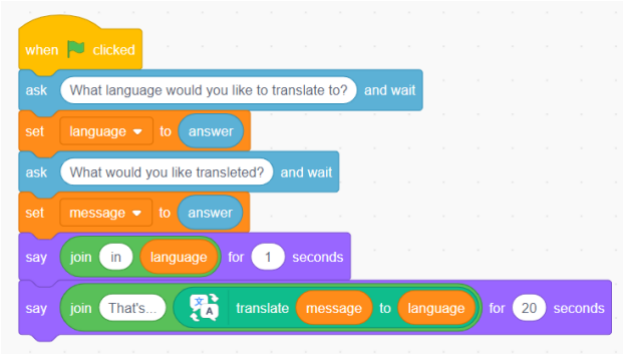
- Computer and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as offering additional time and providing extra resources.

Hint for the solution:



To create a sort of translator, you need to use not only the 'events' and 'control' blocks but also the 'sensors,' 'operators,' and, most importantly, a new 'translate' extension. Also, it is necessary to create two variables: 'language' and 'message. The code must create a program. that prompts the user for what language they would like to translate to, as well as the message they would like translated, and then translates the message from English to their chosen language.

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Beginner Level

ICT CHALLENGES

3.1 Robotics

3.1.1 How can I make my robot follow a predefined path?

Learning Support | Beginner level lesson plan example

Challenge description:

I need to secretly deliver a note with a message to a classmate. How can I build and program a robot that moves on the floor without bumping into desks and chairs?

Getting Started Guide

This challenge promotes a practical, beginner-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming a robot and its corresponding programming software. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Understanding basic robotics concepts, such as motors, sensors, and visual block programming, using educational kits.
- Applying acquired knowledge to design and build a functional robot capable of performing specific tasks.
- Enhancing problem-solving skills by addressing practical challenges during the robot's construction and programming.
- Fostering collaboration and teamwork through shared projects, encouraging communication and idea exchange among participants.

Material required:

- Computer and internet connection;
- Educational robotics kits (Ideally, there would be one kit per participant, but if there aren't many kits available, groups of two to four participants can be formed).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as flexible work times, additional resources, or individual assistance during robot programming and assembly.

Hint for the solution:

For this first challenge, you could choose the same robot model for everyone and, as a first step, have the students build the robot following the instructions (for example, a propulsion structure.) Moreover, it is not strictly necessary to use sensors, but it is possible to make the robot move forward, turn right, and turn left to follow a predefined path. It is recommended to work by selecting units of measurement (cm or inches) in the 'movement' blocks.

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Beginner Level

ICT CHALLENGES

3.1 Robotics

3.1.2 How many sides does the square have?

Learning Support | Beginner level lesson plan example

Challenge description:

During math class, we are talking about the square. How can I explain the characteristics of a square using a robot? The robot needs to move to draw a square.

Getting Started Guide

This challenge promotes a practical, beginner-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming a robot and its corresponding programming software. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Understanding basic robotics concepts, such as motors, sensors, and visual block programming, using educational kits.
- Applying acquired knowledge to design and build a functional robot capable of performing specific tasks.
- Enhancing problem-solving skills by addressing practical challenges during the robot's construction and programming.
- Fostering collaboration and teamwork through shared projects, encouraging communication and idea exchange among participants.

Material required:

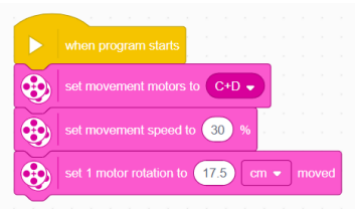
- Computer and internet connection;
- Educational robotics kits (Ideally, there would be one kit per participant, but if there aren't many kits available, groups of two to four participants can be formed).

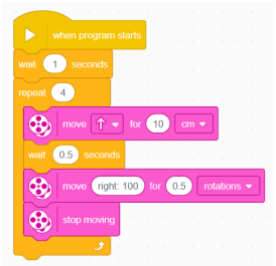
How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as flexible work times, additional resources, or individual assistance during robot programming and assembly.

Hint for the solution:





You can use the 'movement' blocks to make the robot go straight for a certain distance and then turn, without the use of a gyroscope.

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Beginner Level

ICT CHALLENGES

3.1 Robotics

3.1.3 What should I do when I am in front of a traffic light with my bicycle?

Learning Support | Beginner level lesson plan example

Challenge description:

Create a robot that simulates a pedestrian or vehicle crossing. The robot needs to be instructed to perform the correct actions in response to a traffic light.

Getting Started Guide

This challenge promotes a practical, beginner-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming a robot and its corresponding programming software. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Understanding the concept of respecting traffic rules.
- Acquiring skills in programming colour recognition and responding to traffic light signals.
- Developing awareness of road safety and the importance of following rules.

Material required:

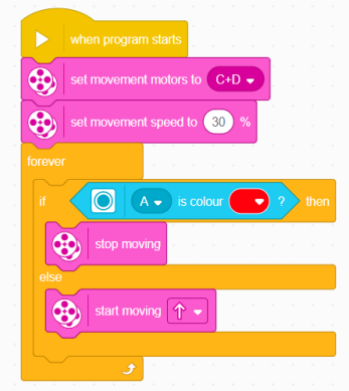
- Computer and internet connection;
- Educational robotics kits (Ideally, there would be one kit per participant, but if there aren't many kits available, groups of two to four participants can be formed), with colour sensors.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as flexible work times, additional resources, or individual assistance during robot programming and assembly.

Hint for the solution:



For this challenge, build a robot that represents a pedestrian or a vehicle waiting to cross the road. The robot should learn to perform the correct actions in response to a traffic light. Program the robot to recognize a traffic light state (green, yellow, red) using the appropriate sensors. The robot should react appropriately to the traffic light state, such as moving when the light is green and stopping when it is red. Ensure that the robot crosses the road while respecting the traffic light rules, similar to how a responsible pedestrian or driver would.

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Beginner Level

ICT CHALLENGES

3.1 Robotics

3.1.4 Stop and Go!

Learning Support | Beginner level lesson plan example

Challenge description:

When I am on the road in a vehicle, what should I do when I see the STOP sign? How can I simulate the correct behaviour of traffic rules with a robot?

Getting Started Guide

This challenge promotes a practical, beginner-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming a robot and its corresponding programming software. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- The challenge introduces the concept of respecting traffic rules, particularly understanding the meaning of the stop signal and the need to stop and start safely.
- Students will learn how distance sensors can be used to detect objects in the surrounding environment and how to integrate them into robotic projects.
- Building the vehicle and integrating the distance sensor requires the application of engineering concepts, such as designing and assembling physical components.

Material required:

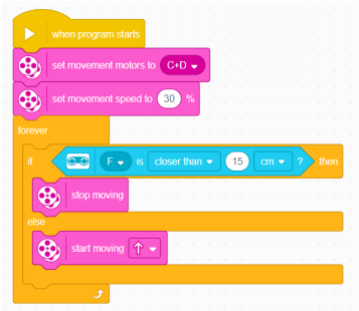
- Computer and internet connection;
- Educational robotics kits (Ideally, there would be one kit per participant, but if there aren't many kits available, groups of two to four participants can be formed) and distance sensors (ultrasound or similar).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as flexible work times, additional resources, or individual assistance during robot programming and assembly.

Hint for the solution:



For this challenge, build your robot as if it were a vehicle and be careful to place the distance sensor in the most suitable position. You can start programming your robot to make it stop when the distance sensor detects an obstacle at a certain distance and make it move when the sensor does not detect any obstacles.

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Intermediate Level

ICT CHALLENGES
3.2 Robotics
3.2.1 How does an autonomous vehicle work?

Learning Support | Intermediate level lesson plan example

Challenge description:

In the real world, LiDAR technology or ultrasonic and infrared sensors are often employed in autonomous vehicles to detect and avoid obstacles such as vehicles, pedestrians, and fixed objects. along the way. Design and program a robot capable of navigating around an obstacle.

Getting Started Guide

This challenge promotes a practical, intermediate-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming a robot and its corresponding programming software. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Acquiring knowledge about the technology and operation of infrared sensors used to detect the presence of obstacles.
- Gaining practical experience in connecting and using infrared sensors on a robot, as well as understanding how software and hardware collaborate for navigation.
- Understanding the basic principles behind such systems and developing valuable skills in the field of robotics and autonomous vehicle engineering.
- Exploring the ethical and legal issues related to the implementation and use of autonomous vehicles, including aspects such as legal responsibility and privacy.

Material required:

- Computer and internet connection;
- Educational robotics kits (Ideally, there would be one kit per participant, but if there aren't many kits available, groups of two to four participants can be formed) and distance sensors.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as flexible work times, additional resources, or individual assistance during robot programming and assembly.

Hint for the solution:

For this challenge, you can use an ultrasonic or infrared sensor to recognize an obstacle. You must program your robot to walk straight, but as soon as it detects an obstacle at a certain distance, it should navigate around it and then continue walking straight.

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Intermediate Level

ICT CHALLENGES
3.2 Robotics
3.2.2 Sumo Robots

Learning Support | Intermediate level lesson plan example

Challenge description:

Sumo is an ancient Japanese sport. The bout begins when both wrestlers are ready, and the main objective is to push the opponent out of the fighting circle or make any part of their body, except the feet, touch the ground. Design and build your robot with the understanding that it will engage in battles with other robots, and program it to force your opponents out of the fighting circle.

Getting Started Guide

This challenge promotes a practical, intermediate-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming a robot and its corresponding programming software. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Students must design and build a unique sumo robot, considering factors such as shape, weight, and features that influence performance in the ring.
- If the challenge involves multiple participants, promote collaboration in design and competition among sumo robots. This stimulates learning through idea sharing and observing different strategies.
- Address any issues that may arise during sumo battles and develop creative solutions to improve performance.

Material required:

- Computer and internet connection;
- Educational robotics kits (Ideally, there would be one kit per participant, but if there aren't many kits available, groups of two to four participants can be formed).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as flexible work times, additional resources, or individual assistance during robot programming and assembly.

Hint for the solution:

The robot design is free, but you need to consider the shape, robustness, ensuring that no part can fall off during the fight. You also need to think about how to make it as fast as possible (for example, try designing a robot with four drive wheels!). Then, you'll have to program it. You can consider making changes to both the robot's structure and code after the initial fights and understanding the programming logic of your opponents.

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Intermediate Level

ICT CHALLENGES
3.2 Robotics
3.2.3 What are service robots and how do they work?

Learning Support | Intermediate level lesson plan example

Challenge description:

A service robot is used in the industry to carry out complex and repetitive tasks in place of humans. Program a robot to simulate a service robot walking along a predetermined path by following a black line for the transportation of objects.

Getting Started Guide

This challenge promotes a practical, intermediate-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming a robot and its corresponding programming software. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Students must learn how sensors, such as light or color sensors, work to perceive the surrounding environment.
- Design control algorithms that allow the robot to follow the line efficiently and precisely.
- Improve the robot's behavior to enhance performance, such as tracking speed or the ability to handle curves and intersections.

Material required:

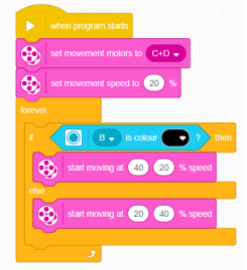
- Computer and internet connection;
- Educational robotics kits (Ideally, there would be one kit per participant, but if there aren't many kits available, groups of two to four participants can be formed) with colour sensors.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as flexible work times, additional resources, or individual assistance during robot programming and assembly.

Hint for the solution:



For this challenge, it is necessary to use the colour sensor to alternately detect two colours (for example, black and white). If the sensor reads the colour black, the robot should move in one direction; otherwise, if the sensor reads white, it should move in the opposite direction. In the case of line following, the motor structure needs to make small and quick movements (most likely below 10 degrees, oscillating between the white and black spaces).

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Advanced Level

ICT CHALLENGES
3.3 Robotics

3.3.1 Is there a relationship between the number of sides and the angles of a regular polygon?

Learning Support | Advanced level lesson plan example

Challenge description:

Drawing a square is simple even if you don't know the value of the interior angles. But how do you draw an equilateral triangle? Or a pentagon? Or a decagon? Program your robot to move following the shapes of regular polygons, changing only the number of sides.

Getting Started Guide

This challenge promotes a practical, advanced-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming a robot and its corresponding programming software. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Application of mathematical knowledge to robotic programming, developing skills in using mathematical formulas to control the movement and geometry of the robot.
- Acquiring an understanding of mathematical concepts related to regular polygons, such as triangles, squares, pentagons, etc.
- Promotion of creativity in how robots tackle the challenge, encouraging students to think of new ways to use programming to create interesting and complex designs.
- Introduction to the Use of Gyroscope (Gyroscopes are commonly employed in devices such as smartphones, tablets, drones, and spacecraft to monitor orientation and stabilise the device).

Material required:

- Computer and internet connection;
- Educational robotics kits (Ideally, there would be one kit per participant, but if there aren't many kits available, groups of two to four participants can be formed) with gyroscope.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as flexible work times, additional resources, or individual assistance during robot programming and assembly.

Hint for the solution:

For this challenge, since we need to set up a mathematical formula that relates the number of sides to the interior angles of regular polygons, a sensor designed to detect variations in the angular orientation of a device is necessary: the gyroscope. A gyroscope measures angular velocity, which is the speed at which an object rotates around a specific axis.

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Advanced Level

ICT CHALLENGES
3.3 Robotics
3.3.2 Radar-inspired Obstacle Detector

Learning Support | Advanced level lesson plan example

Challenge description:

A radar (Radio Detection and Ranging) is a detection and localization system that uses radio waves to identify, track, and determine the distance and speed of objects within its field of observation. Simulate the operation of a radar and activate alarms (auditory and visual) on your robot, when the distance sensor (ultrasonic or infrared) detects an obstacle at a certain distance.

Getting Started Guide

This challenge promotes a practical, advanced-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming a robot and its corresponding programming software. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Hardware integration, programming, and real-world applications, providing hands-on experience in the field of robotics and sensor technology.
- Exploration of the principles of radar technology and how it is used for obstacle detection in real-world applications.
- Study of the numerous applications of radar in reality: Air and Maritime Navigation, Security Systems, Autonomous Vehicles, Astronomical Sciences, etc.

Material required:

- Computer and internet connection;
- Educational robotics kits (Ideally, there would be one kit per participant, but if there aren't many kits available, groups of two to four participants can be formed) with distance sensors.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as flexible work times, additional resources, or individual assistance during robot programming and assembly.

Hint for the solution:

For this challenge, a distance sensor (ultrasonic or infrared) is required to recognize an obstacle at a certain distance. Once the obstacle is detected, the robot must emit auditory and visual alarms. However, be careful! The radar (distance sensor) must make a precise movement: it should rotate right and left, simulating the exact movement of a real radar.

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Advanced Level

ICT CHALLENGES
3.3 Robotics
3.3.3 The drawing robot.

Learning Support | Advanced level lesson plan example

Challenge description:

In the real world, a robot programmed to draw precise geometric shapes could be used in the production of printed circuits, creation of architectural models, or decoration of artistic surfaces. Design one yourself that can draw polygons with a marker.

Getting Started Guide

This challenge promotes a practical, advanced-level project in the field of coding using visual block-based programming. Participants are tasked with tackling the challenge by programming a robot and its corresponding programming software. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 50 min

Learning objectives:

- Integration of mathematical skills, programming, and artistic creativity, providing a comprehensive learning experience in robotics.
- Experimentation with different sizes of polygons, colours, and drawing styles, encouraging creativity in the interpretation of regular polygons.

Material required:

- Computer and internet connection;
- Educational robotics kits (Ideally, there would be one kit per participant, but if there aren't many kits available, groups of two to four participants can be formed) with gyroscope.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- adapt instructions to be clear and understandable for different learning styles, using, for example, written instructions, verbal guidance, or explanatory images;
- provide personalised support based on students' needs, such as flexible work times, additional resources, or individual assistance during robot programming and assembly.

Hint for the solution:

Program your robot so that, using a marker, it can draw regular polygons with varying numbers of sides on a flat surface. You will need to develop a mathematical formula that, based on the specified number of sides, calculates the required interior angles to achieve precise geometric shapes. Ensure that the robot can control the speed of movement and adapt the trajectory to guarantee accurate and creative drawings. Make sure that your robot, after drawing the first polygon, lifts the marker from the paper, moves, and draws the next polygon after placing the marker back on the paper. After drawing regular polygons, try programming your robot to make it write something or draw something artistic!

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Beginner Level

ICT CHALLENGES
4.1 Microcontrollers
4.1.1 How can I program a virtual die with microcontrollers?

Learning Support | Beginner level lesson plan example

Challenge description:

When rolling a die, you can observe and analyse the frequency with which different outcomes occur, providing a tangible experience in applying probability concepts. I can program Microbit to simulate a virtual die that randomly displays a number when shaken.

Getting Started Guide

This challenge promotes a practical beginner-level project in the field of programming using visual block-based programming. Participants are tasked with facing the challenge by programming codes that can interact with electronic microcontrollers with the external world. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for future activities.

Time: 50 min

Learning objectives:

- Acquiring basic programming skills using a visual language like MakeCode for Microbit.
- Understanding and applying concepts such as conditional statements, loops, and random number generation.
- Connecting the practical experience of rolling the die to probability theory, understanding the relationship between expected outcomes and frequency of occurrence.
- Stimulating creativity through program customization, encouraging students to add unique elements such as sounds, visual effects, or stories related to the die.

Material required:

- Computer and internet connection;
- Microbit electronic board with USB cable.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- offer personalised guidance to address specific needs of students, such as managing particular sensors or actuators, or adapting code to meet specific requirements;
- ensure ongoing support during activities by responding to students' questions and providing the necessary assistance to overcome any technical challenges.

Hint for the solution:

You can use input blocks to select the block that triggers Micro:bit with shaking, and then from the math blocks, choose the block that selects numbers from 1 to 6 randomly. To make the challenge more interesting, participants can be encouraged to further customise the program. For instance, they can add sounds or visual effects to the die roll or incorporate timing to control how long the die result is displayed before the program waits for a new shake.

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Beginner Level

ICT CHALLENGES
4.1 Microcontrollers

4.1.2 How can I measure the noise in the classroom using microcontrollers?

Learning Support | Beginner level lesson plan example

Challenge description:

Having a sound level alert system can be extremely beneficial in the classroom. When the noise exceeds a predefined limit, the Microbit could activate a visual or auditory signal to alert students and teachers to maintain a quieter environment. Program Microbit to function as a sound level meter.

Getting Started Guide

This challenge promotes a practical intermediate-level project in the field of programming using visual block-based programming. Participants are tasked with facing the challenge by programming codes that can interact with electronic microcontrollers with the external world. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for future activities.

Time: 50 min

Learning objectives:

- Acquire knowledge about reading data from the Microbit's sound sensor.
- Use programming blocks to process and display real-time data.
- Understand the importance of being aware of sound levels in different situations and develop awareness of the surrounding environment through noise measurement.

Material required:

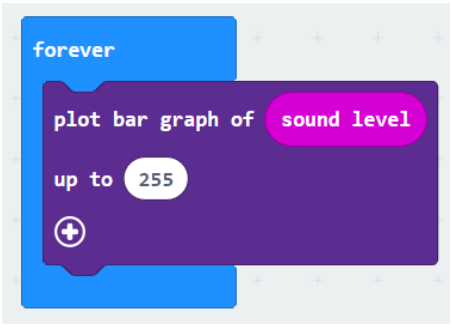
- Computer and internet connection;
- Microbit electronic board with USB cable.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- offer personalised guidance to address specific needs of students, such as managing particular sensors or actuators, or adapting code to meet specific requirements;
- ensure ongoing support during activities by responding to students' questions and providing the necessary assistance to overcome any technical challenges.

Hint for the solution:



Inside a 'forever' block, you can insert the 'plot bar graph...' block from the 'LED' block group. Here, we set the maximum level of the sound level to be 255. It is possible to customise the code by adding other details, such as an alarm sound when the maximum allowed level is exceeded. In Microbit, the maximum noise level is set to 255 because it represents the highest possible value in an 8-bit encoding, which is common in many computer systems. In an 8-bit system, you can represent values from 0 to 255, inclusive.

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Beginner Level

ICT CHALLENGES
4.1 Microcontrollers
4.1.3 Let's create a flashing warning light signal.

Learning Support | Beginner level lesson plan example | Apply to your world

Challenge description:

Your task is to design and create a simple electrical circuit using an Arduino board and a LED. The main objective is to make the LED flash in a specific pattern.

Getting Started Guide

This challenge promotes a practical beginner-level project in the field of programming using visual block-based programming. Participants are tasked with facing the challenge by programming codes that can interact with electronic microcontrollers with the external world. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for future activities.

Time: 50 min

Learning objectives:

- Acquiring basic programming skills using a visual language like TinkerCAD Circuit or the Arduino language.
- Gaining a deep understanding of basic concepts related to electrical circuits.

Material required:

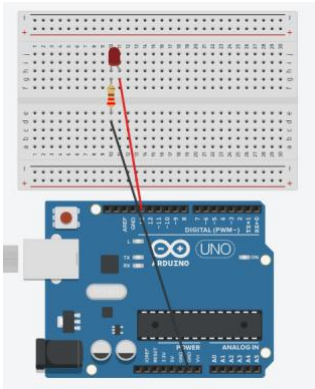
- Computer and internet connection;
- Arduino electronic board with breadboard,a led, an electrical resistor and USB cable.
- If you don't have an Arduino kit, you can use an online simulator (for example, Tinkercad Circuit).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;;
- offer personalised guidance to address specific needs of students, such as managing particular sensors or actuators, or adapting code to meet specific requirements;
- ensure ongoing support during activities by responding to students' questions and providing the necessary assistance to overcome any technical challenges.

Hint for the solution:



In this case, Arduino is used solely to provide electrical power to the circuit. Using a breadboard, connect the Arduino board and an LED. Make sure you understand the correct arrangement of elements in the circuit. Don't forget to use a resistor to avoid burning the LED. Write a program, in Arduino language or in a visual language, that controls the LED according to the desired pattern. You can experiment with the duration of flashes, brightness, or other parameters of your choice.

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Beginner Level

ICT CHALLENGES
4.1 Microcontrollers

4.1.4 How to open and close an electrical circuit with a button?

Learning Support | Beginner level lesson plan example | Apply to your world

Challenge description:

Your task is to design and create a simple electrical circuit using an Arduino board, a LED and a button. The main objective is to make the LED flash when the button is pushed.

Getting Started Guide

This challenge promotes a practical beginner-level project in the field of programming using visual block-based programming. Participants are tasked with facing the challenge by programming codes that can interact with electronic microcontrollers with the external world. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for future activities.

Time: 50 min

Learning objectives:

- Gaining a thorough understanding of how a button can be used to open and close an electrical circuit.
- Learning to correctly connect a button and an LED to an Arduino board using a breadboard.

Material required:

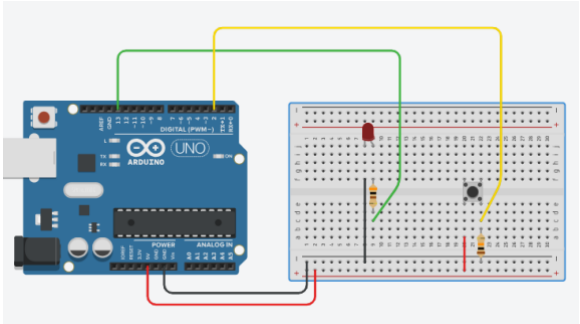
- Computer and internet connection;
- Arduino electronic board with breadboard,a led, an electrical resistor, a button and USB cable.
- If you don't have an Arduino kit, you can use an online simulator (for example, Tinkercad Circuit).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- offer personalised guidance to address specific needs of students, such as managing particular sensors or actuators, or adapting code to meet specific requirements;
- ensure ongoing support during activities by responding to students' questions and providing the necessary assistance to overcome any technical challenges.

Hint for the solution:



Set a condition such that if the button is pressed, then the LED turns on; otherwise, if the button is not pressed, the LED remains off. You must use the 'if-else' block (with a visual language) or Write a program in the Arduino language that allows the user to control the LED's on/off state by pressing the button. A microcontroller can be used to control electronic devices in response to external inputs.

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Intermediate Level

ICT CHALLENGES
4.2 Microcontrollers
4.2.1 How many degrees are there? And which degrees?

Learning Support | Intermediate level lesson plan example

Challenge description:

How many temperature scales are there? What is the difference? How many Kelvin and Fahrenheit degrees correspond to 20 degrees Celsius? Program a digital thermometer, with microcontrollers, capable of reading and displaying the ambient temperature, performing the conversion between the three scales.

Getting Started Guide

This challenge promotes a practical intermediate-level project in the field of programming using visual block-based programming. Participants are tasked with facing the challenge by programming codes that can interact with electronic microcontrollers with the external world. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for future activities.

Time: 50 min

Learning objectives:

- Foster understanding of fundamental scientific concepts related to temperature measurement.
- Use programming blocks to process and display real-time temperature data.
- Understand how microcontrollers interact with the surrounding environment through temperature measurement.

Material required:

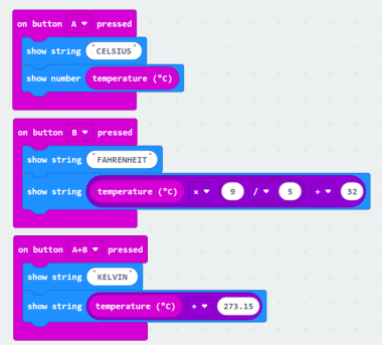
- Computer and internet connection;
- Microbit electronic board with USB cable.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- offer personalised guidance to address specific needs of students, such as managing particular sensors or actuators, or adapting code to meet specific requirements;
- ensure ongoing support during activities by responding to students' questions and providing the necessary assistance to overcome any technical challenges.

Hint for the solution:



Microbit has a built-in temperature sensor. To read the ambient temperature, simply use the 'input' block called 'temperature (°C),' which returns the temperature reading in degrees Celsius. To then convert to various temperature scales, write the corresponding formulas using the 'math' blocks. Extensions to this basic code are possible, such as adding the ability to set alarms for temperatures above or below certain values.

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Intermediate Level

ICT CHALLENGES
4.2 Microcontrollers
4.2.2 Step by Step

Learning Support | Intermediate level lesson plan example

Challenge description:

During physical education class, it is crucial to understand the importance of physical activity and monitoring daily activity to study the relationship between physical activity and health. Program a digital step counter with Micro:bit.

Getting Started Guide

This challenge promotes a practical intermediate-level project in the field of programming using visual block-based programming. Participants are tasked with facing the challenge by programming codes that can interact with electronic microcontrollers with the external world. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for future activities.

Time: 50 min

Learning objectives:

- Promote awareness of the importance of physical activity through programming a step counter.
- Connect programming with health and wellness concepts through monitoring physical activity.
- Apply programming skills in a practical and engaging context.
- Introduce scientific concepts related to acceleration and human body movements.

Material required:

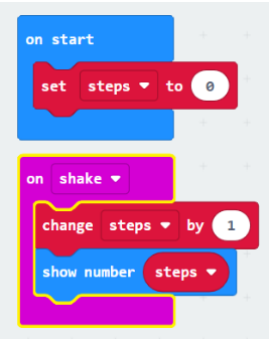
- Computer and internet connection;
- Microbit electronic board with USB cable.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- offer personalised guidance to address specific needs of students, such as managing particular sensors or actuators, or adapting code to meet specific requirements;
- ensure ongoing support during activities by responding to students' questions and providing the necessary assistance to overcome any technical challenges.

Hint for the solution:



Using the integrated accelerometer sensor, participants will need to create a program that monitors movements and counts the number of steps. It is necessary to create a new variable that we will call 'steps' and set it to zero. Modify the value of the 'steps' variable by one point with each shake. The basic program can be extended, for example, by implementing a function that calculates calories burned based on the number of steps or by creating a leaderboard of students based on the number of steps taken.

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Intermediate Level

ICT CHALLENGES
4.2 Microcontrollers
4.2.3 We communicate in Morse code with microcontrollers!

Learning Support | Intermediate level lesson plan example

Challenge description:

How can I communicate with my peers using a coded language? How can I program my Microbit to communicate with other Microbits in Morse code?

Getting Started Guide

This challenge promotes a practical intermediate-level project in the field of programming using visual block-based programming. Participants are tasked with facing the challenge by programming codes that can interact with electronic microcontrollers with the external world. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for future activities.

Time: 50 min

Learning objectives:

- Acquiring basic programming skills using a visual language like MakeCode for Microbit.
- Promote understanding of Morse code as an alternative form of communication and introduce the concept of multimodal communication, combining light and sound signals.
- Foster collaboration among students and the ability to present their work to others.

Material required:

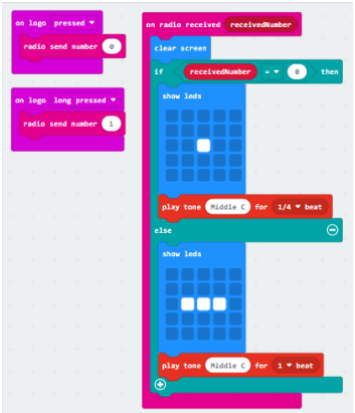
- Computer and internet connection;
- Microbit electronic board with USB cable.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- offer personalised guidance to address specific needs of students, such as managing particular sensors or actuators, or adapting code to meet specific requirements;
- ensure ongoing support during activities by responding to students' questions and providing the necessary assistance to overcome any technical challenges.

Hint for the solution:



To make two Micro:bits communicate with each other, it is necessary to use radio blocks to send and receive messages. In this case, to simulate Morse code, we associate a dot and a short sound with 0, and a dash and a long sound with 1. We achieve this using the 'if true then else' block. The dot and dash are visualised using the LED matrix block to illuminate the Microbit's LEDs. Now, it's just a matter of learning Morse code!

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Advanced Level

ICT CHALLENGES
4.3 Microcontrollers
4.3.1 How can adjustable lighting be created?

Learning Support | Advanced level lesson plan example | Apply to your world

Challenge description:

Imagine turning the dimmer of a lamp: when you turn it to the right, the light gradually increases; when you turn it to the left, the light gradually decreases.

Getting Started Guide

This challenge promotes a practical advanced-level project in the field of programming using visual block-based programming. Participants are tasked with facing the challenge by programming codes that can interact with electronic microcontrollers with the external world. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for future activities.

Time: 50 min

Learning objectives:

- Understanding how to use a potentiometer to analogically control the brightness of an LED, experimenting with the gradual variation of the signal.
- Grasping the concept of Pulse Width Modulation (PWM) and how it is used to control the brightness of an LED.
- Reflecting on the practical application of light intensity control in real-world scenarios, such as dimmable lighting in home or industrial settings.

Material required:

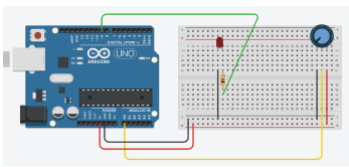
- Computer and internet connection;
- Arduino electronic board with breadboard,a LED, an electrical resistor, a potentiometer and USB cable.
- If you don't have an Arduino kit, you can use an online simulator (for example, Tinkercad Circuit).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- offer personalised guidance to address specific needs of students, such as managing particular sensors or actuators, or adapting code to meet specific requirements;
- ensure ongoing support during activities by responding to students' questions and providing the necessary assistance to overcome any technical challenges.

Hint for the solution:



In fading an LED with a potentiometer, you are controlling the brightness of the LED gradually, similar to adjusting the light intensity of a lamp. Configure pins A0 and 9. Pin A0 is set as an input, as it is used to read the analog signal from the sensor, while pin 9 is set as an output, as it will be used to control the LED. The analog value from the sensor is read and used to control the brightness of the LED.

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Advanced Level

ICT CHALLENGES
4.3 Microcontrollers

4.3.2 Simulating Windshield Wiper Movement with microcontrollers!

Learning Support | Advanced level lesson plan example | Apply to your world

Challenge description:

During the vehicle automation class, the professor needs to explain the functioning of the windshield wiper. Try simulating its movement with the help of microcontrollers.

Getting Started Guide

This challenge promotes a practical advanced-level project in the field of programming using visual block-based programming. Participants are tasked with facing the challenge by programming codes that can interact with electronic microcontrollers with the external world. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for future activities.

Time: 50 min

Learning objectives:

- Students will apply their theoretical knowledge to create a practical project, enhancing their understanding of electronic programming and the use of components like the servo motor.
- Simulating with a servo motor provides a hands-on and visual experience, facilitating the understanding of the connection between electronic control and mechanical motion in real-world applications.

Material required:

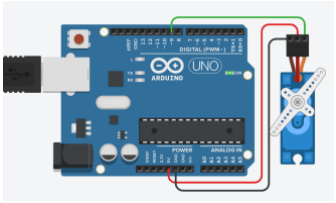
- Computer and internet connection;
- Arduino electronic board with breadboard, a servo motor and USB cable.
- If you don't have an Arduino kit, you can use an online simulator (for example, Tinkercad Circuit).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- offer personalised guidance to address specific needs of students, such as managing particular sensors or actuators, or adapting code to meet specific requirements;
- ensure ongoing support during activities by responding to students' questions and providing the necessary assistance to overcome any technical challenges.

Hint for the solution:



This project uses a servo motor with Arduino to perform a "sweep" movement from 0 to 180 degrees and then from 180 to 0 degrees. The movement occurs with increments or decrements of 1 degree. Optionally, explore the integration of sensors (such as humidity or rain sensors) to automatically activate windshield wiper movement based on simulated environmental conditions or create a user interface using buttons or other inputs to allow the user to manually activate the windshield wiper movement.

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Advanced Level

ICT CHALLENGES
4.3 Microcontrollers
4.3.3 Alarm Management for High Temperatures.

Learning Support | Advanced level lesson plan example | Apply to your world

Challenge description:

Activating a high-temperature alarm is crucial to prevent damage, ensure safety, and preserve the optimal functionality of devices, systems, and heat-sensitive environments.

Getting Started Guide

This challenge promotes a practical advanced-level project in the field of programming using visual block-based programming. Participants are tasked with facing the challenge by programming codes that can interact with electronic microcontrollers with the external world. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for future activities.

Time: 50 min

Learning objectives:

- Applying Arduino programming in real-world scenarios, such as monitoring and controlling temperature in specific environments, devices, or applications.
- Exploring the concept of automation and environmental control, detecting and automatically responding to temperature variations.
- Understanding how to calibrate or use the sensor's datasheet to arithmetically convert the pin value into a temperature reading in the desired scale.

Material required:

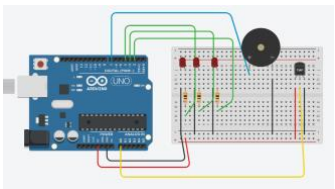
- Computer and internet connection;
- Arduino electronic board with breadboard, LEDs, electrical resistors, a temperature sensor, a buzzer, and USB cable.
- If you don't have an Arduino kit, you can use an online simulator (for example, Tinkercad Circuit).

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- promote collaboration among students and encourage peer support, so they can learn from each other and mutually support one another;
- offer personalised guidance to address specific needs of students, such as managing particular sensors or actuators, or adapting code to meet specific requirements;
- ensure ongoing support during activities by responding to students' questions and providing the necessary assistance to overcome any technical challenges.

Hint for the solution:



Microcontrollers have pins for analog inputs where suitable temperature sensors can be connected. Arduino needs to be programmed to read the value from the input pin and, depending on calibration or the sensor's datasheet, arithmetically convert it into a temperature value in the chosen scale. This value can be printed on the serial monitor and used with 'if then else' statements to activate indicator lights (LEDs) or sound alarms (buzzers).

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Beginner Level

ICT CHALLENGES
5.1 Web Development
5.1.1 How can I start to learn the basics of HTML and CSS?

Learning Support | Beginner level lesson plan example

Challenge description:

Web development starts with the fundamentals of HTML and CSS. By following Code.org's learning path, students can gain a solid understanding of these core concepts.

Getting Started Guide

This challenge encourages a practical, beginner-level project in web development using visual block-based programming and introducing the students to the basic tags and rules using HTML and CSS. They will be challenged to follow the learning path for web development created on code.org. Following this path the students will learn the basics of web development and the importance and objectives of designing a web site. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 60

Learning objectives:

- Learn the basics of web development
- Learn the basics of HTML and CSS and introduce certain tags and rules to the students;
- Create HTML elements to structure the webpage
- Apply CSS rules to change the style of the website,

Material required:

- Computer with a mouse and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- Varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- If the participants have a more advanced level, they can skip the initial lessons and start directly on the more advanced ones.

Hint for the solution:

Invite the students to follow the learning path, supporting them as needed, trying to motivate the students to use the internet to look for the answer or solution instead of directly giving the answer. If there are some more advanced students the teacher can make them start from a more advanced step.

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Beginner Level

ICT CHALLENGES
5.1 Web Development
5.1.2 How can I create my first webpage?

Learning Support | Beginner level lesson plan example

Challenge description:

Students will explore web development concepts through interactive block-based coding tools. This will help them grasp how HTML elements and CSS rules work together to build a webpage.

Getting Started Guide

This challenge encourages a practical, beginner-level project in web development using visual block-based programming and introducing the students to the basic tags and rules using HTML and CSS. They will be challenged to create a personal website displaying their skills, hobbies or interests. The teacher will ask the students to ideate and design a web site using codedragon.org or app.edublocks.org to develop it using a minimum of HTML tags (like *img*, *p*, *a*, *ol* and *ul*) and CSS rules (to change the background colour, font style, font colour, ecc.). Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 60-90 min

Learning objectives:

- Learn the basics of HTML and CSS and introduce certain tags and rules to the students;
- From the model created on pen and paper, be able to create a website organising the different HTML elements;
- Apply CSS rules to change the style of the website,
- Iterate over the design to improve the website.

Material required:

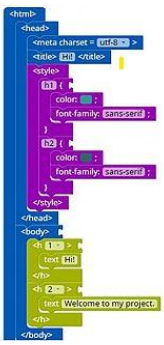
- Pen and paper for the design part
- Computer with a mouse and internet connection;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- Varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- Asking the participants to use more advanced HTML elements;
- Propose CSS challenges like adding 'hover' selectors or advanced rules for more advanced participants.
- Ask the participants to iterate over the design to improve their website

Hint for the solution:



Start by explaining if needed the basic concepts of Web Development, HTML and CSS and then how to interact with the website. The students should start by adding the basic block for the web structure (HTML, head and body) and then add the HTML blocks and CSS rules needed to create the desired website that they have designed.

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Beginner Level

ICT CHALLENGES
5.1 Web Development
5.1.3 How can I reuse and debug an already existing HTML/CSS code?

Learning Support | Beginner level lesson plan example

Challenge description:

Building on their knowledge of HTML and CSS, students will tackle a challenge: debugging existing code. This will solidify their understanding of web structure and equip them with the skills to effectively utilise online code resources.

Getting Started Guide

This challenge encourages a practical, intermediate-level project in web development HTML and CSS programming in order to improve the skills and make the students more comfortable to apply changes and detect errors on a web page. They will be challenged to study an already existing web page in order to find all the HTML and CSS errors and fix the web site. The teacher will give the students an already created web page but with basic html tag and css rules errors and will ask the students to analyse the code, understanding what it should show, and fix the present errors in order to visualise the correct web page. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 90 min

Learning objectives:

- Reinforce the basics of HTML and CSS;
- Increase the skills of the students to read the code, understanding what is the meaning of each HTML tag and CSS rule present on the code;
- Know the basic mistakes that can be made when developing and how to fix them;
- Make the student more comfortable in understanding web code and understand how to modify it in order to reuse it.

Material required:

- Computer with a mouse, internet connection and some code editor like Sublime Text;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- Varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- Giving tips to the students in order to find the errors;
- Show how the web site should look if all the errors are fixed.

Hint for the solution:

Give the students a code of a simple webpage with some HTML and CSS errors, for example:

- HTML tags without closure;
- Wrong attributes on HTML tags;
- Wrong CSS rules as applying white font colour over white background;

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Intermediate Level

ICT CHALLENGES
5.2 Web Development

5.2.1 How can I understand how to develop a webpage based on a client request?

Learning Support | Intermediate level lesson plan example

Challenge description:

Ever wonder how web pages come to life? In this challenge, students will step into the shoes of both client and developer. By working together, they'll gain a deeper understanding of client needs and how those needs translate into the development process.

Getting Started Guide

This challenge encourages a practical, intermediate-level project in web design and development HTML and CSS programming in order to improve the student skills. The teacher will provide a simple website to the students. Then, pairing them, he will ask each pair to act as developer and the client, providing if needed different roles for the client (for example: tourists, athletes, people with children, etc). The students that act as developers will have to interview the clients in order to understand how to modify the website to fulfil their needs. The students can iterate more than one type and repeat the interview session in order to understand how the design-thinking cycle works. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 120 min

Learning objectives:

- Reinforce the basics of HTML and CSS;
- Increase the skills of the students to read the code, understanding what is the meaning of each HTML tag and CSS rule present on the code;
- Make the student more comfortable in understanding web code and understand how to modify it in order to reuse it.
- Make the students understand the basics of the design-thinking process and the web design in general.

Material required:

- Computer with a mouse, internet connection and some code editor like Sublime Text;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- Varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- Giving tips to the students in order to find the errors;
- Ask to adapt further the website offering more capabilities to those students that already feel comfortable with web development

Hint for the solution:

An idea for this exercise can be to offer the students a website of their city. Depending on the client the students will have to change the information shown on the city, for example, if the clients are athletes, they will showcase all the sport facilities that the city can offer and also change the style of the website to make it more appealing for the target audience.

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Intermediate Level

ICT CHALLENGES
5.2 Web Development
5.2.2 How can I create an online gallery to show my last trip pictures?

Learning Support | Intermediate level lesson plan example

Challenge description:

Ready to create an online gallery? In this challenge the students will use Javascript events to create a clickable gallery to see different pictures.

Getting Started Guide

This challenge encourages a practical, intermediate-level project in web development using JavaScript in order to improve the student skills. The teacher will introduce the students with the basic notions of how JavaScript events can be used to add interactivity to a web page, changing its content dynamically in base to the events and actions of the user. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 120 min

Learning objectives:

- Reinforce the basics of HTML and CSS;
- Introduce the students to JavaScript and how to add dynamicity to a web site based on the events triggered by the user.

Material required:

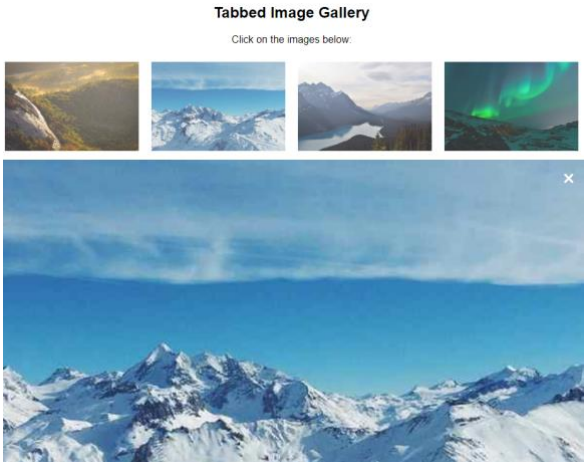
- Computer with a mouse, internet connection and some code editor like Sublime Text;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- Varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- Helping the students on how Javascript events work and how to program them;
- Ask to adapt further the website offering more capabilities to those students that already feel comfortable with web development.

Hint for the solution:



The teacher will ask the students to develop a simple web page or will provide the students with a simple template. In these templates there will be a series of pictures that, using the 'onclick' event will be shown full width on another container of the webpage. The event 'onmouseover' and 'onmouseout' can be used to change the style of the pictures preview to change their opacity and add a border when the user hovers one of them. An example on how to create this webpage can be found here.

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Intermediate Level

ICT CHALLENGES
5.2 Web Development

5.2.3 How can I create an online shopping example with some interactivity?

Learning Support | Intermediate level lesson plan example

Challenge description:

Ready to build a web page for a shop? This challenge introduces JavaScript, a powerful tool that lets you create interactive web experiences. Students will learn how to dynamically change a shop's initial page based on user actions, making it more engaging and user-friendly.

Getting Started Guide

This challenge encourages a practical, intermediate-level project in web development using JavaScript in order to improve the student skills. The teacher will introduce the students with the basic notions of how JavaScript can be used to add interactivity to a web page, changing its content dynamically in base to the events and actions of the user. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 120 min

Learning objectives:

- Reinforce the basics of HTML and CSS;
- Introduce the students to the concepts of 'Id' and 'Classes' and how to use them on JavaScript
- Introduce the students to JavaScript and how to add dynamicity to a web site based on the events triggered by the user.

Material required:

- Computer with a mouse, internet connection and some code editor like Sublime Text;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- Varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- Giving tips to the students in order to find the errors;
- Ask to adapt further the website offering more capabilities to those students that already feel comfortable with web development.

Hint for the solution:

The teacher will ask the students to develop a simple web page or will provide the students with a simple template, for example, an e-commerce website where the user can pick the colour of a shirt and the amount to buy. Using JavaScript, the students will have to add the feature to change the colour of the picked t-shirt, changing in this way the shown image, and calculate the price in base to the amount that the user introduces. The students can use a web page already developed by them to add any feature that they desire or suggested by the instructor.

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Intermediate Level

ICT CHALLENGES
5.2 Web Development

5.2.4 How can I adapt the layout of my webpage for both desktop and mobile?

Learning Support | Intermediate level lesson plan example

Challenge description:

In this challenge, students will dive into Bootstrap's grid system, empowering them to build responsive web pages that seamlessly adapt to desktops and mobile devices. They'll gain hands-on experience with Bootstrap's powerful features, laying the foundation for future web development projects.

Getting Started Guide

This challenge encourages a practical, intermediate-level project in web development using Bootstrap framework in order to improve the student skills. The teacher will introduce the students with the basic notions of how Bootstrap classes can be used in order to fastly modify the website appearance, using the grid system in order to organise the different elements of our webpages and make them responsive, adapting both to desktops and mobile devices. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 120 min

Learning objectives:

- Reinforce the basics of HTML and CSS;
- Introduce the students to Bootstrap framework, learning how to use the different classes and the grid system;
- Using this grid system, the student will organise their elements on a full-width header and three responsive columns.

Material required:

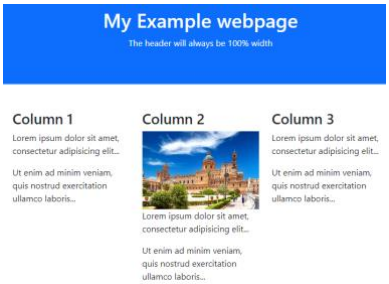
- Computer with a mouse, internet connection, a web browser and some code editor like Sublime Text.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- Varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- Giving tips to the students in order to help them understanding Bootstrap classes and grid system;
- Ask to adapt further the website offering more Bootstrap capabilities to those students that already feel comfortable with web development.

Hint for the solution:



The teacher will explain the students Bootstrap, explaining some classes that modify their webpage contents and explaining how to use the grid system in order to organise the layout of their web page. The teacher will explain how to import Bootstrap library on the students project in order to start using it. After it, some examples on how to create a small website can be found on this source. The final objective is to reorganise an already created web page or create a brand new one using bootstrap, having in this way a grid structure that will change the columns display depending on the device size. After understanding the basics the teacher should encourage the students to go to Bootstrap web page and try other features.

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Advanced Level

ICT CHALLENGES
5.3 Web Development
5.2.2 How can I create an online calculator?

Learning Support | Advanced level lesson plan example

Challenge description:

Create a basic calculator online to do basic mathematical operations.

Getting Started Guide

This challenge encourages a practical, intermediate-level project in web development using JavaScript in order to improve the student skills. The teacher will introduce the students with the basic notions of how to create the calculator interface using HTML and CSS and how, through JavaScript, the students can add the needed interctivity in order to create a realtime calculator online.

Time: 120 min

Learning objectives:

- Reinforce the basics of HTML, CSS and JavaScript;
- Introduce the students on how to mix together the use of HTML/CSS and Javascript in order to create a fully functional website.

Material required:

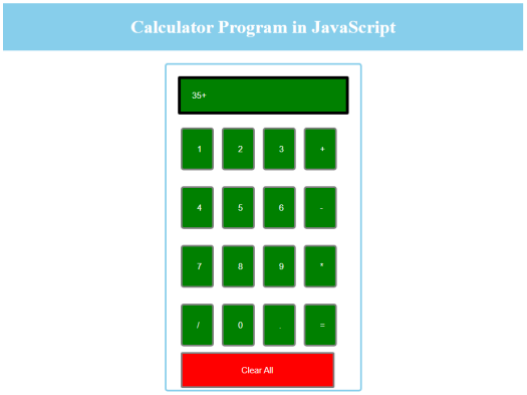
- Computer with a mouse, internet connection and some code editor like Sublime Text;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- Varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- Giving the students a HTML/CSS webpage with the basic structure instead of making them do it from scratch. The students will have to improve this webpage and add all the JavaScript functionalities;
- Ask to adapt further the website offering more capabilities to those students that already feel comfortable with web development.

Hint for the solution:



The teacher will ask the students to develop a simple web page or will provide the students with a simple template. In this template the basic structure of the calculator buttons will be present. The students will add the events to each button where, for each button, the symbol will be added to the display. When the whole operation is present on the display and the '=' button is pressed, the operation result will be overwritten on the LED. An example on how to create this webpage can be found here.

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Advanced Level

ICT CHALLENGES
5.3 Web Development

5.3.2 How can I turn off my home lights if I forgot to do it before going out?

Learning Support | Advanced level lesson plan example

Challenge description:

Have you ever left home in a hurry and don't remember if you have turned off the light before leaving? How can I develop a web interface for the sensors and actuators at home?

Getting Started Guide

This challenge encourages a practical, advanced-level project in web development using JavaScript, HTML and CSS and microcontroller knowledge in order to set a home WiFi and create a web interface that can check the state of the lights and turn them on or off. For this challenge is advised also a medium level of understanding on microcontrollers.

The teacher will introduce the students with the basic notions of how JavaScript can be used to add interactivity to a web page, changing its content dynamically in base to the events and actions of the user. Always conclude the activity by gathering real-time feedback on both perceived usefulness and any suggestions for further activities.

Time: 120 min

Learning objectives:

- Reinforce the basics of HTML, CSS and JavaScript;
- Reinforce the knowledge on microcontrollers;
- Introduce the students to the concept of IoT, or how to drastically improve the usability of their circuits thanks to the connection with the internet.

Material required:

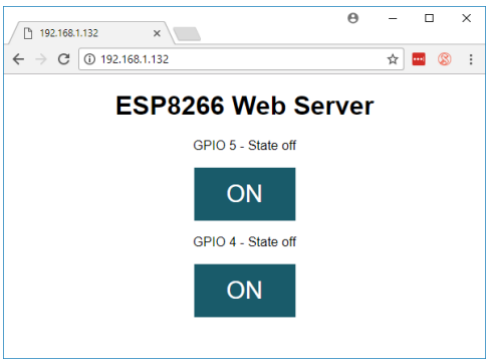
- Computer with a mouse, internet connection and some code editor like Sublime Text;
- Microcontroller with wireless connectivity, like ESP8266.

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- Varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;

Hint for the solution:



The teacher can consult and show the students this guide in order to understand the circuit and the code needed to do this activity. A simple circuit using a microcontroller like ESP8266 with 2 leds lights has to be made. After this, using Arduino, the teacher will show how to use the microcontroller to create a web server and create a webpage with 2 buttons to turn on or off the LEDs. The students will be able to connect to the newly created network in order to access this page and control the circuit remotely.

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Advanced Level

ICT CHALLENGES
5.3 Web Development

5.3.3 I want to render my webpage more personalised, storing and using the client name to make it more friendly

Learning Support | Advanced level lesson plan example

Challenge description:

Create a small webpage written in PHP that shows a form, after the client fills his name the webpage shown will be personalised for the client.

Getting Started Guide

This challenge encourages a practical, advanced-level project in web development using HTML, CSS and PHP in order to create a website on a test server that is able to read the info sent on a form and store it in order to use it when rendering the webpage. The teacher will introduce the students to the PHP language and how it works to process the data on the server.

Time: 120 min

Learning objectives:

- Introduce the students to PHP;
- Reinforce the basics of HTML, CSS;
- Approach the students to the concepts of server and how the data is processed when a request is made.

Material required:

- Computer with a mouse, internet connection and some code editor like Sublime Text;

How to adapt to different learners/special needs learners:

The level of complexity or any potential adaptation for special needs learners can be modulated by:

- Varying the trainer/tutor's involvement in guiding the participant step by step based on their abilities;
- Providing with the base web page where the students can work and providing small snippets of code that can hint the students what they have to do

Hint for the solution:

```php
<?php
$name = $_POST['name'];
$email = $_POST['email'];
$message = $_POST['message'];
$from = 'From: My Contact Form';
$to = 'test@test.org';
$subject = 'Wassup?';
$body = "From: $name\n E-Mail: $email\n Message:\n $message";
if ($_POST['submit']) {
    if (mail ($to, $subject, $body, $from)) {
        echo '<p>Message Sent Successfully!</p>';
    } else {
        echo '<p>Ah! Try again, please?</p>';
    }
}
?>
```

The teacher can consult and show the students this guide in order to understand how to create the form and retrieve the data sent by the form. If working locally is needed, the main page with the form can be created on a folder and named 'index.php'. The PHP code called in the form will be found in the same folder and with the same name as the 'action' attribute of the form. This code will store the name inserted on the form in a variable and used in the Html code to show the user name together with the webpage. A local server can be started by opening the Windows Command Line 'cmd.exe', navigating to the project folder and executing the command: 'php -S localhost:8000'. The local server should now start and the project should be accessible through the browser inserting the address: *localhost:8000/index.php*

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6. Extra Resources (4 pages)

APPLICATION AND PLATFORMS:

STAND COURSE and PLATFORM: platform that offers many resources and guides for teachers who want to use digital tools in the classroom, but also for those who are interested in the topic of digitalisation in the world of education. Available in English, Italian, Polish, Greek and Catalan.

Hubs Offers: platform which offers some articles and knowledge about 3D- printing. Available in German, English, French or Dutch.

Website Builder: Wix.com is a user-friendly website building platform where you can create your own site with customizable templates. It supports multiple languages, enabling users to build and interact with their websites in their preferred language.

Robotics Basics: Definition, Use, Terms - Infineon Technologies is a website where you can find a lot of information about technologies, including Robotics. It is available in German, English and Chinese.

SELFIE is a free, easy-to-use, customisable tool to help schools assess where they stand with learning in the digital age.

In eTwinning, teachers organise and run on-site and online activities with their students along with colleagues from countries participating in the Erasmus+ programme. They engage in collaborative projects with the support of the TwinSpace environment.

Kialo Edu is a custom version of Kialo (kialo.com), the world's largest argument mapping and debate site, specifically designed for classroom use. Its clear, visually compelling format makes it easy to follow the logical structure of a discussion and facilitates thoughtful collaboration.

Tinkercad (3D Design; Circuit; Codeblocks) is a free web app for 3D design, electronics, and coding that helps educators build STEM confidence in their students through project-based learning in the classroom. Hands-on projects build confidence, persistence, and problem-solving skills.

Plickers - Plickers is an interactive teaching tool that allows educators to create quizzes and polls to get instant feedback from students.

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Kahoot - An interactive learning platform that allows you to create fun quizzes.

Mentimeter **-** Mentimeter is an interactive presentation and polling tool that allows users to create surveys, quizzes, polls, word clouds and other types of interactive content.

EdPuzzle - is an educational tool that allows teachers to turn videos into interactive lessons. With Edpuzzle, you can incorporate questions, comments and quizzes into videos from various platforms, such as YouTube.

Genially - Genially is an online platform for creating interactive digital content. It allows users to develop presentations, infographics, educational games, interactive images and more.

Pear Deck - Pear Deck is an interactive presentation tool designed for the educational environment. It allows teachers to transform their presentations into more engaging and interactive learning experiences.

Diffit - Teachers use Diffit to get “just right” instructional materials, saving tons of time and helping all students to access grade level content.

Ted-Ed - Is a platform that allows you to create educational lessons. You can design a lesson around the content of the video and create tasks to assess how well students understand the material. You can also use ready-made videos from the specially curated "TED-Ed Originals" section, which features lessons prepared by educators around the world.

50 Ferramentas - This is a website with around 50 tools for teachers. We've reviewed some of them and not all of them are working, but there are several very useful ones. Also, the content is in Portuguese.

MindMup - This is an educational tool that facilitates the creation and cloud storage of mind maps. Teachers may utilise this application to generate presentations, document outlines through mind maps, and disseminate their ideas on social media platforms and the internet.

Planboard - This is a free digital application that easily organises lesson plans in attractive timetables. It allows teachers to organise their classes,

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assign standards, and administer files. Planboard is created in a way that is both user-friendly and functional.

Quizlet - This is a free digital learning tool that provides educational materials addressed to both teachers and students. Quizlet converts content into games, quizzes, and flashcards, enabling users to study the same material in a wide array of forms.

Jamboard - this is the interactive white board for team collaboration created by Google. Users may create a shared canvas, illustrate and write on it, save it to the cloud, and come back with additional work anytime.

Coogle - a tool for creating diagrams in a great visual way. It's appropriate for users who wish to deliver a structural explanation of a topic.

Padlet Padlet is an online collaborative platform that allows users to create digital bulletin boards, known as "Padlets," to which they can add various content such as text, images, videos, links, and documents. It serves as a versatile tool for collaboration, brainstorming, and information sharing, enabling multiple users to contribute and interact in real-time on a visually organised canvas.

Seesaw is a digital portfolio and communication tool that enhances student engagement and facilitates communication between teachers, students, and parents. Teachers can assign and review tasks, provide feedback, and showcase student work in a secure and user-friendly digital environment

Socrative: Socrative is a real-time assessment app that allows teachers to create quizzes, polls, and interactive activities to gauge student understanding. It provides instant feedback, making it a valuable tool for formative assessments in a digital classroom setting.

3DBear: 3DBear is an augmented reality (AR) app that enables students to create and interact with 3D models. It can be used to enhance lessons in various subjects, allowing students to visualize and explore concepts in an immersive way.

Ozobot: Ozobot is a small programmable robot that students can code using color-coded markers. It's a fun and accessible way to introduce

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coding and robotics concepts, allowing students to create paths and commands for the robot to follow.

PODCASTS AND VIDEO:

The Robot Report Podcast: Discussions on the latest news and trends in robotics. The podcast provides insights into the robotics industry, including discussions on market trends, emerging technologies, and the impact of robotics on various sectors.

Robohub Podcast: Interviews with experts in the field of robotics. The Robohub Podcast is likely centred around robotics, artificial intelligence, and related technologies.

CodeNewbie: CodeNewbie is a podcast designed for individuals who are new to coding. It explores the personal journeys of people who have transitioned into coding, sharing their challenges, successes, and insights.

Syntax Podcast: Syntax is a podcast hosted by Wes Bos and Scott Tolinski, both experienced web developers and educators in the programming community.

RobotShop TV- Youtube Channel: Tutorials and reviews on various robotics products. It provides a variety of videos, including tutorials, product reviews, demonstrations and discussions.

The Coding Train: The Coding Train is a YouTube channel and educational platform that focuses on creative coding and making coding accessible to a broad audience, including beginners.

Youtube channel- Paul McWhorter: Paul McWhorter's YouTube channel is dedicated to educational content, particularly in the field of electronics, Arduino, and programming.

Traversy Media: Brad Traversy provides comprehensive tutorials on web development, including HTML, CSS, JavaScript, and various frameworks.

The Net Ninja- Youtube Channel: The Net Ninja is a popular YouTube channel hosted by Shaun Pelling and focuses on providing comprehensive tutorials and courses on web development and programming.

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YouTube Channel - Thomas Sanladerer: Thomas Sanladerer's YouTube channel is dedicated to 3D printing and additive manufacturing.

The EdSurge Podcast: This podcast covers a wide range of topics related to education technology and digital learning trends. It features interviews with experts, educators, and innovators, providing valuable insights for anyone involved in digital learning.

BOOKS AND ARTICLES:

Introduction to Autonomous Robots by Nikolaus Correll et al. (2022): This book offers a comprehensive exploration of autonomous robotic systems, covering fundamental principles, sensor integration, and real-world applications.

Robotics: Modelling, Planning and Control by Bruno Siciliano et al. (2008): The book Robotics: Modelling, Planning and Control is a comprehensive resource that covers fundamental concepts and advanced topics in the field of robotics.

Clean Code: A Handbook of Agile Software Craftsmanship by Robert C. Martin (2008): Clean Code is dedicated to the principles and practices of writing clean, maintainable, and efficient code in the context of agile software development.

Eloquent JavaScript by Marijn Haverbeke (2018): Eloquent JavaScript is a comprehensive guide to JavaScript programming.

Microcontrollers Fundamentals for Engineers and Scientists by Steven F. Barrett and Daniel J. Pack (2007): The book is designed to provide a fundamental understanding of microcontrollers tailored for engineers and scientists.

3D Printing For Dummies by Richard Horne and Kalani Kirk Hausman (2023): The book is likely geared towards beginners and individuals who are new to the world of 3D printing.

The 3D Printing Handbook by Ben Redwood et. al (2017): The book is likely designed to be a comprehensive guide covering various aspects of 3D printing.

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An Urgency of Teachers: the Work of Critical Digital Pedagogy by Sean Michael Morris and Jesse Stommel:This collection of essays explores the authors' work in, inquiry into, and critique of online learning, educational technology, and the trends, techniques, hopes, fears, and possibilities of digital pedagogy

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References

Coffman, T. (2017). *Inquiry-based learning: Designing instruction to promote higher level thinking*. Rowman & Littlefield.

Darling-Hammond, L., & Richardson, N. (2009). Teacher learning: What matters? *Educational Leadership, 66*(5), 46-53.

European Commission, Directorate-General for Education, Youth, Sport and Culture. (2020). *Education and training monitor 2020 – Executive summary*. Publications Office. https://data.europa.eu/doi/10.2766/581621

European Commission. (2017). *The Digital Education Action Plan*. https://op.europa.eu/en/publication-detail/-/publication/fcc33b68-d581-11e7-a5b9-01aa75ed71a1/language-en

European Commission. (2018). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Digital Education Action Plan*. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0022&from=EN

European Commission. (2020). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Achieving the European Education Area by 2025*. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0624

European Commission. (2020). *Digital Education Action Plan (2021-2027)*. https://education.ec.europa.eu/focus-topics/digital-education/action-plan

European Commission. (2020). *Digital Education Action Plan: Factsheet*. https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-factsheet-sept2020_en.pdf

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European Commission. (2023). *European Year of Skills 2023*. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-year-skills-2023_en

Fraillon, J., Ainley, J., Schulz, W., Friedman, T., & Duckworth, D. (2019). *Preparing for life in a digital world: IEA International Computer and Information Literacy Study 2018 International Report*. Amsterdam: International Association for the Evaluation of Educational Achievement (IEA).

Fraillon, J., Ainley, J., Schulz, W., Friedman, T., & Gebhardt, E. (2014). *Preparing for life in a digital age: the IEA International Computer and Information Literacy Study International Report*. Cham: Springer.

IMDb. (n.d.). Retrieved from https://www.imdb.com

International Society for Technology in Education. (n.d.). *ISTE Standards*. Retrieved from https://iste.org/standards

Kaendler, C., Wiedmann, M., Rummel, N., & Spada, H. (2015). Teacher competencies for the implementation of collaborative learning in the classroom: A framework and research review. *Educational Psychology Review, 27*(3), 505-536. https://doi.org/10.1007/s10648-014-9288-9

Kola, L. (2020). Global mental health and COVID-19. *SAGE Open, 10*(3). https://doi.org/10.1177/2158244020938702

Nurse-Clarke, N. (n.d.). *Ice-breaker Tuesday: Describe yourself with an emoji*. Retrieved from https://www.natashanurseclarke.com/blog/ice-breaker-tuesday-describe-yourself-with-an-emoji

ScienceDirect. (2016). *Article on ScienceDirect*. https://www.sciencedirect.com/science/article/pii/S2452301116300062#s0010

Upskill. (n.d.). Retrieved from https://upskill.pt/

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World Economic Forum. (2023). *The Future of Jobs Report 2023*. https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf

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