SCIENCE e-ROBOT

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COMPREHENSIVE MEASUREMENT AND EVALUATION TOOLKIT

Turkey: Hadiye Kuradacı Science and Ard Center, 2022
(Project Coordinator)

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CONTENT

1.1. INTRODUCTION

This toolkit was developed by the project consortium in collaboration with a group of project partners who designed and developed the activities listed in this toolkit, as part of the "Integration of Educational Robotics into the Scientific Learning Teaching Process" project funded by the Erasmus+ Program of the European Union.

In our world where the rapid development of technology, structural changes in the workforce and socio-economic developments are experienced, individuals who want to find better jobs and take part in society as active citizens need a wide range of competencies. These qualifications, which are of fundamental importance for the European Education Area, are called key competences. The implementation of the core qualifications framework published by the European Commission is on the agenda of all Member and Candidate States. However, practices for the assessment of these qualifications have not yet been fully reflected in the efforts of EU countries to integrate competency-based education into the school curriculum. Research shows that there is no single best practice method and no universal combination to fully measure and evaluate core competences and transversal skills. In this context, there is an understanding that various methods and types of assessment should be used to comprehensively assess various skills.

This toolkit is based on process-oriented assessment that enables students to actively participate in the assessment process of their own learning, and result-oriented assessment approaches that include observable and comparable learning outcomes. It has been designed taking into account the types of formative and summative assessments. The most relevant innovative and transferable to learning environments; presenting measurement and evaluation tools in various modern teaching models that represent today's interdisciplinary approach.

Therefore, this toolkit contains effective measurement and evaluation methods and techniques that will ensure the efficiency of the science teaching process for the use of science teaching professionals. In addition, the toolkit represents an international (project consortium) effort to mediate common tools for science teachers and even other subject teachers around the world in the measurement and evaluation of 21st century skills and scientific achievements. In this direction, we hope that it will be encouraging and facilitating for teaching professionals in measuring and evaluating scientific learning outcomes and key skills.

1.2. PROJECT PARTNERS

Consortium structure; 4 public schools providing education for students aged 10-17 from Turkey, Italy, Portugal and Romania; a software company from Germany; a central education authority (MONE ORGM) and a public university from Turkey.

PP	Country	Organization
P0	Turkey	Hadiye Kuradacı Science and Art Center
P1	Turkey	Ministry of Education General Directorate of Special Education and Guidance Services
P2	Turkey	Mersin University
P3	Germany	ROBYCODE UG
P4	Portugal	Agrupamento De Escolas De Portela E Moscavide
P5	Italy	Istituto Istruzione Scolastica Superiore “Carlo Alberto Dalla Chiesa
P6	Romania	Liceul National De Informatica Arad

1.3. WHY SHOULD THIS TOOLKIT BE USED IN EDUCATION APPLICATIONS?

The rapid developments in the 21st century, which is called the age of technology, have been effective in every field and have led to a change in the field of education as students are intertwined with technology. With the integration of technology into education, education and technology used in education have become concepts that cannot be considered independently from each other, and this has led to the development of educational Technologies (Gürdoğan, 2020). In this context, it is seen that various educational technologies have been developed that appeal to all sensory organs of the students in the classroom, enable them to actively participate in the learning process and contribute to their affective characteristics (Alpar, Batdal & Avcı, 2007).

It is seen that the use of educational technologies plays a role in creating effective learning environments, adapting individuals to the developing and changing world, increasing the quality of education and acquiring 21st century skills, which have recently been emphasized in all education programs as being essential to a full learning process. Robotic coding applications, one of the uses of technology in education, facilitate students' understanding of abstract concepts and subjects that they perceive as difficult (Miglino, Lund &Cardaci, 1999) and increase teachers' productivity (applicability to new methods and techniques) (Roblyer & Edwards, 2000).

Performing robotic activities in learning environments enables students to work as a team, it also plays a role in the realization of fun and effective learning (Bers, Flannery, Kazakoff & Sullivan, 2014). Regarding this, Bers (2010) states that the use of robotics in learning environments improves students' ability to understand and solve problems. In addition, robotic activities support the development of many skills of students such as critical thinking, discovering their own abilities, learning by doing, learning by doing, problem solving, being more willing to use technology and increasing their level of use (Costa &Fernandes, 2005).

Science education aims to keep up with science and scientific developments, to establish the relationship between Science, Technology, Society and Environment (STSE) and to raise scientifically literate individuals (Aktamış & Şahin Pekmez, 2011). In line with this goal, teachers should take advantage of alternative methods and techniques that enable meaningful learning to actively construct knowledge by putting students at the center rather than actively transferring knowledge through expression, and making use of technological tools in learning environments (Yaman, Bal İncebacak & Sarışan Tungaç, 2019).

In an ongoing cycle from the past to the present, the education system has undergone various changes as a result of the changes that have taken place in line with the needs. While computer and web-based technologies have been widely used in science education until recently; robots produced with the development of robotics science have been integrated into our education system and are being integrated. The functional activities of the new generation robots offer a wider use in the commercial, social and educational fields going forward. These broad-based usage features make life easier technologically, increase the quality and speed of education, and shorten the learning process (Kılınç et al., 2013).

Along with the increase in the knowledge and skills that students need to acquire with technological developments, measurement and evaluation tools and approaches are also changing. One of the most important indicators of whether the learning-teaching process is effective and how much gains are achieved is the evaluation process. There are many alternative assessment and evaluation tools that teachers can use besides traditional assessment tools. In the science curriculum, there is an understanding of measurement and evaluation in which the

process is evaluated as well as the product in measurement-evaluation. Therefore, at the end of the process, it is recommended to evaluate the student's performance together with the learning product (Alpar, Batdal & Avcı, 2007).

1.4. HOW TO USE THIS TOOLKIT?

There is an understanding that various methods and types of assessment should be used to evaluate various skills and learning objectives in a comprehensive and participatory way. The toolkit designed according to this understanding includes a variety that can suit the interests and competencies of the users.

This toolkit has been prepared in three parts. The first chapter provides an overview of 21st century skills, scientific literacy, assessment and evaluation. Also, the first part; it contains various tips and recommendations for effective measurement and evaluation.

Chapter 2 explains measurement and evaluation approaches and their types. In this section, process and results-oriented evaluation are discussed in detail. On the other hand, it defines formative and summative assessment from a broad perspective. It offers various recommendations for these types of assessment, as well as tools and techniques that can be used in formative assessment. It also includes assessment methods used to assess various skills.

Chapter 3 presents the practical tools used in modern learning models. It describes the methods, techniques, and tools that can be used in formative assessment. It also includes effective steps, recommendations and various tools that can be used with a participatory approach in the use of these techniques and tools. In addition, it presents examples of internationally developed good practices; it explains alternative measurement and evaluation tools that include digital technologies such as Web 2.0 and offers various tools that can be used in the learning process. Users can use these tools by arranging them to fit the course content and learning objectives.

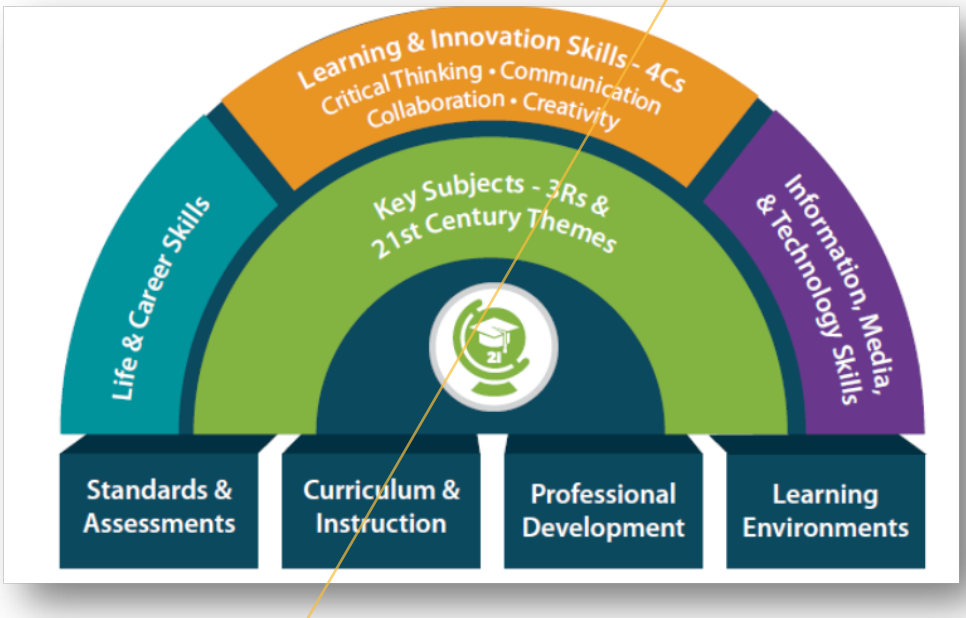
OVERVIEW OF THE TOOLKIT

1.5. OVERVIEW OF THE TOOLKIT

1.5.1 The Definition of 21st Century Key Competences and Skills

The rapid development of technology, structural changes in the workforce and socioeconomic developments are experienced, individuals who want to find better jobs and take part in society as active citizens need a wide range of competencies. These qualifications, which are of fundamental importance for the European Education Area, are called key competencies. In addition, these competencies are valued and encouraged for personal development, employment, sustainable lifestyle, inclusive and active citizenship. Universities, governments and businesses from around the world have worked together to understand the skills that children will need to succeed in the 21st century (Ananiadou & Claro, 2009). At this point, it is important to define the terms "skill" and "competence". According to Collins Dictionary skill is defined as a special ability in a task, sport, etc. especially an ability acquired by training (Collins Dictionary, 2022). In addition, competence is identified as the quality or state of being able or suitable for a particular task; the quality or state of being competent for a particular task (TDK, 2022). It is understood that these two terms have similar meanings.

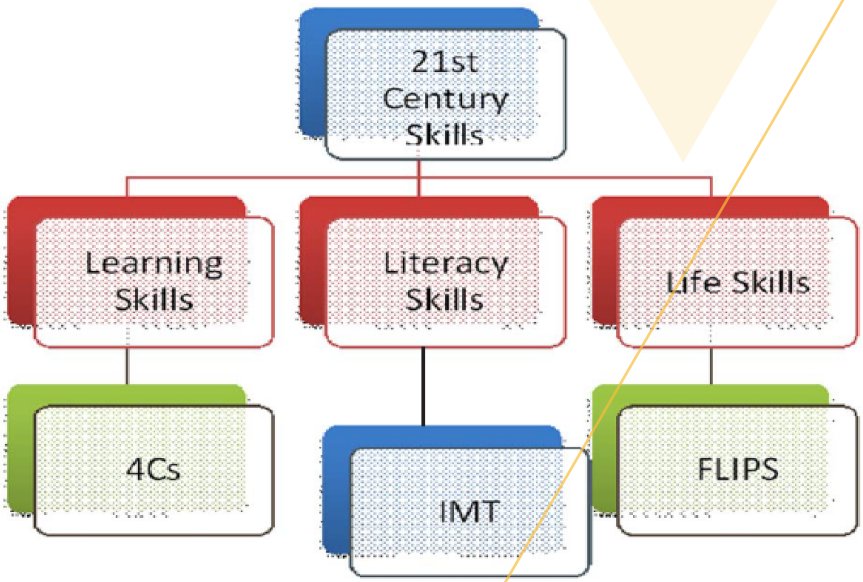
"21st century skills" or "21st century competencies" are seen as critical components of education. International education systems prepare students with 21st century competencies that will enable them to face complex challenges now and in the future (Battelle for Kids, 2019).



Graphic 1. 21st century student outcomes (Battelle for Kids, 2019)

Partnership for 21st Century Learning (P21) provided eleven competencies, listed into 3 skill sets (OECD, 2020):

- **Learning Skills-Learning and Innovation Skills:** The skills required for the acquisition of new knowledge - Critical Thinking, Creativity & Innovation, Collaboration, Communication (4C)
- **Literacy Skills-Information, Media and Technological Skills:** The skills that help in creating and gaining new knowledge through reading, media and digital resources - Information Literacy, Media Literacy, Technology Literacy (IMT)
- **Life Skills-Life and Career Skills:** The skills required for successfully leading everyday life - Flexibility and Adaptability, Leadership and Responsibility, Initiative and Self-Direction, Social and Cross-Cultural Interaction (FLIPS)



Graphic 2. Classification of 21st Century Skills (OECD, 2020).

Learning and innovation skills focus on creativity, critical thinking, communication, and collaboration which are essential to prepare students for the future. Creativity and innovation skills include thinking creatively, working creatively with others and implementing innovations. Critical thinking and problem solving skills include reasoning effectively and solving problems. Communication and collaboration skills include communicating clearly.

Information, media and technological skills focus on information technology and media literacy. Information literacy skills include accessing and evaluating information and using and managing information. Media literacy skills include analysing media, creating media products and applying technology effectively.

Life and career skills focus on flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, leadership and responsibility. Flexibility and adaptability skills include adopting to change and being flexible. Initiative and self-direction skills include managing goals and time and working independently. Social and cross-cultural skills include interacting effectively with others, work effectively in diverse teams. Productivity and accountability skills include managing projects (OECD, 2020).

21st century skills are an intermingled set of abilities both practical and intellectual allowing to perform a wide range of tasks and get to valuable achievements, something that individuals need to be able to fully participate in and contribute to the knowledge society. A rich literature on the categorization, definition, and application of these skills has been generated. The literature on 21st century skills is based on the assumption that the new century requires different skills for individuals to function effectively in every walk of life (Ananiadou & Claro, 2009). According to Dede (2009) 21st century skills have been given as follows by Metiri Group and NCREL:

Digital-Age Literacy

- Basic, scientific, economic, and technological literacies
- Visual and information literacies
- Multicultural literacy and global awareness

Inventive Thinking

- Adaptability, managing complexity, and self-direction
- Curiosity, creativity, and risk taking
- Higher-order thinking and sound reasoning

Effective Communication

- Teaming, collaboration, and interpersonal skills
- Personal, social, and civic responsibility
- Interactive communication

High Productivity

- Prioritizing, planning, and managing for results
- Effective use of real-world tools
- Ability to produce relevant, high-quality products

Moreover; Erdem et al (2019) declines 21st skills strictly in the educational field which students should acquire to become fully developed citizens:

- **Collaboration:** Learning how to work effectively and respectfully with other people is an important life skill.

- **Responsibility:** Responsibility is about encouraging children to make a difference to the world in which they live. Children learn that they can inspire and motivate others when they lead by example.

- **Critical thinking:** Critical thinking is about having logical reasons and evidence for conclusions. It is an important skill in academic subjects and for everyday decision-making.

- **Creativity:** The process of playing with ideas and being open to new possibilities has been just as important in the history of human development and achievement.

- **Problem-solving:** In order to solve problems, people need to think in both analytical and creative ways. Problem solving means the ability to handle a challenge, dealing with pressure and persisting until a problem is resolved.

- **Initiative and self-direction:** Self-direction is about having the motivation to achieve and the discipline to complete tasks to a deadline. Research has found that initiative is even more important for academic success than intelligence.

- **Information and communication technologies (ICT) and information literacy:** Children today have access so many different technologies and information. It's important to teach them how to make the most of it.

In addition, an updated "Council Recommendation on Key Competencies for Lifelong Learning" published in 2018, the European Commission defines eight key competences that are seen as an important factor in enhancing the EU's innovation capacity, productivity and competitiveness as follows:

- **Literacy competence:** Expressing and interpreting concepts, ideas, emotions, facts and opinions in oral and written form. It includes linguistic interaction in appropriate and creative manners in societal and cultural contexts.
- **Multilingual competence:** Sharing the fundamental dimensions of communication in the mother tongue.

- **Mathematical competence and competence in science, technology and engineering:** The development and application of mathematical thinking for solving problems in daily situations. Competence is built on solid acquisitions of numeracy, emphasis is placed on process and activity as well as knowledge. Competence also involves the use of modes of specific thinking (logical and spatial thinking) and presentation (formulas, patterns, construction, graphs and diagrams).

Competence in science refers to the use of the corpus of knowledge and methodology used to explain the natural world, identify questions and draw conclusions based on empirical data. Competence in technology refers to the application of knowledge and methodologies in response to human needs. Competence also includes understanding the changes brought about by human activity as well as responsibility as a citizen to them.

- **Digital competence:** Using new technologies in the workplace and in leisure time. It involves using the computer to access, evaluate, store, produce, present, exchange information, as well as communicating and participate in networks via the Internet.

- **Personal, social and learning to learn competence:** Perseverance and persistence in learning, organizing one's own learning, including time and information management at both individual and individual level group. It also involves awareness of the learning process and needs, identifying opportunities as well as overcoming obstacles to be successful in learning. It involves acquiring and processing new knowledge and skills such as seeking support for learning. Motivation and confidence are crucial for this competence.

- **Citizenship competence:** Effective and constructive participation in social and professional life and conflict resolution in diverse societies. Civic competence leads to participation in civic life based on knowledge of social and political concepts and structures and involvement in active and democratic participation.

- **Entrepreneurship competence:** It means turning ideas into action. It includes creativity, innovation, risk-taking as well as project development and management. This competence supports subjects in everyday life, as well as in the workplace to seize opportunities. It includes more specific skills and knowledge for those who contribute to the development of commercial and social activities.

- **Cultural awareness and expression competence:** It is important to express ideas, experiences and emotions through music, art and literature for this competence.

Characteristics of Competences:

- It represents an extensive list of key competencies to ensure flexible adaptation to a rapidly changing and profoundly interconnected world.
- All key competencies are equally important, because each of them can contribute to a successful life in the knowledge society.
- Many of these competencies are intertwined. Aspects considered essential in one area support the development of skills in another field.
- It relates to personal life (at home, in leisure), social life, and professional life (in society, at work) by connecting learning contexts (formal/non-formal) and learning purposes.
- The set of key competencies is flexible by adapting to new socioeconomic and cultural challenges (Official Journal of the EU, 2006).

Importance of 21st Century Competencies:

The reasons why it is increasingly important to focus on 21st century competencies are explained in the literature as follows:

- Changes in the workforce from an industrial model of production to a rapidly transforming, technology-driven, and interconnected globalized knowledge economy.
- Emerging evidence on how to optimize learning, including the use of technological innovations.
- Changing expectations on the part of learners, who are demanding an education system that is more connected and relevant to their everyday lives.

Education's big goal is to prepare students to contribute to the world of work and civic life and to make them play part in solving collective problems like solving global warming, curing diseases and ending poverty. Therefore it is important to help as many children as possible learn to apply 21st century skills. To help educators integrate skills into the teaching environment, the Partnership for 21st Century Learning (P21) has developed a unified, collective vision for learning known as the Framework for 21st Century Learning which describes the skills, knowledge, and expertise that students need to master in work and life (Battelle for Kids, 2019).

All key competencies are considered equally important, and aspects required in one area will support competency development in the other. For example, skills such as critical thinking, problem solving, teamwork, communication, creativity, negotiation, analytical thinking, working collaboratively, and cross-cultural skills are patterned into core competencies. The acquisition of key competencies is not limited to schools. It is developed throughout life in the family, school, work environment, local and other communities through formal, non-formal and informal learning.

Key competencies that appear to be an important factor in lifelong learning are expressed as a combination of knowledge, skills and attitudes. In the study named "Key Competencies for Lifelong Learning" published by the European Commission in 2019:

- **Knowledge** is composed of the concepts, facts and figures, ideas and theories which are already established, and support the understanding of a certain area or subject.
- **Skills** are defined as the ability to carry out processes and use existing knowledge to achieve results.
- **Attitudes** describe the disposition and mindset to act or react to ideas, persons or situations.

On the other hand, the Future of Jobs Report 2020 (WEF) study has listed the top 10 skills, expressed as key/cross skills, required in 2025 for finding better jobs and employment:

- Analytical thinking and innovation,
- Active learning and learning strategies,
- Complex problem solving,
- Critical thinking and analysis,
- Creativity, originality and initiative,
- Leadership and social influence,
- Technology use, monitoring and control,
- Technology design and programming,
- Resilience, stress tolerance and flexibility,
- Reasoning, problem-solving and ideation.

Social and economic transformations in contemporary information societies require new ways of thinking and learning. Therefore, knowledge alone is not considered sufficient and various cross-skills are also needed. A wider range of skills and abilities are needed to take part in societies as active citizens in a dynamic landscape characterized by the growing importance of information and communication technologies (ICT), the decline of functional skills-based occupations, and increasing competition with globalisation. Therefore, in the light of all this information, the importance of key competences and skills for active citizenship cannot be denied. In particular, it is very important for school-age children and young people to develop these competences and skills from an early age so that they can make tangible contributions to their own lives and well-being in the years to come.

1.5. OVERVIEW OF THE TOOLKIT

1.5.2 The Importance of Measurement and Evaluation in 21st Century Key Competences and Skills

Since the goal of 21st century education is to prepare students for the future workplace, the assessment of the required skills must provide necessary information to determine students' ability. Thus current and standardised practice of assessment techniques fail to meet this purpose (Aghazadeh, 2019). To evaluate students' performance in the required areas, a wide spectrum of assessments which equip them with the ability to interact with peers and provide them with appropriate and timely feedback is needed (Rupp et al, 2010). Researchers emphasized the importance of measuring 21st century skills and stated that to understanding the process through which these competencies develop and how students progress from one skill to the next are essential for educators (Soland, Hamilton & Stecher, 2013). The acquisition of

21st century skills such as problem solving, critical thinking, communication, cooperation and self-management during school years is decisive for countries to take part in the competitive market in the future. For this reason, it is thought that especially developing countries should pay more attention to this situation (Yalçın, 2018).

Considering the 21st century skills' components, assessment of 21st century skills must be (Battelle for Kids, 2019):

- Include high-quality standardized testing along with effective formative and summative classroom assessments
- Emphasize useful feedback on student performance that is embedded into everyday learning
- Require a balance of technology-enhanced, formative, and summative assessments that measure student mastery of 21st century skills
- Enable the development of portfolios of student work that demonstrate mastery of 21st century skills to educators and prospective employers
- Enable a balanced portfolio of measures to assess the educational system's effectiveness in reaching high levels of student competency in 21st century skills.

In addition the major characteristics and requirements of 21st century skills assessment, are highlighted in the literature. According to these studies assessment designs must be authentic and deal with real-world problems so that assessment tasks actually stimulate, prompt and facilitate the capture of the targeted skills (Care & Kim, 2018) and also must be complex and challenging enough to promote student engagement, motivation, as well as their cognitive and critical thinking skills (Lai & Viering, 2012). Moreover an assessment tool has validity, which means, while measuring a skill of interest, a test may measure some aspect of that competency consistently but fail to capture other essential aspects of that competency.

And also it has high reliability which means that, it provides useful information about students' skills in the tested area (Soland, Hamilton & Stecher, 2013).

The use of technology in assessment is also important feature to help combine learning, teaching and assessment. Researchers agreed that combining technology with assessment has positive effects that can be more effective as ICT enables quicker results, reduces the cost and time required to score, and facilitates feedback. In this respect ICT can be used to design a transformative assessment system to measure 21st century skills (Aghazadeh, 2019).

Researchers emphasized the properties required for 21st century skills assessment. They stated that "what is assessed", "the purpose of assessment", and "how the assessment takes place" are fundamental properties (Shaffer & Gee, 2012). The first step in the process of assessment of 21st century skills is to define the skills and their constructs. The skills should be clear for students to solve problems or think critically in the presence or absence of that subject and transfer their skills from one context to another and must be defined in measurable terms to design assessment tasks (Koenig, 2011).

The goal of assessment as learning is to guide students to be active, self-regulated and critical assessors in their process of learning. The assessment of 21st century skills can be both summative and formative. While summative assessments focus on making judgements about how well individuals consider learning (Ecclestone, 2010), formative assessments emphasize evaluating learners' progress during the process of learning (Bennett, 2011). In addition, the purpose of summative assessments is to emphasize reliability and accountability, assessing a limited number of performances and contexts, however the purpose of formative assessments is emphasising overall validity, assessing more performances in a wider range of contexts. During the assessment process of 21st century skills, it is important to create a balance between formative and summative assessments of student achievement which requires making diagnostic and comprehensive assessments of their competencies (Shute, 2009).

The implementation of the core competencies framework published by the European Commission is on the agenda of all Member States. However, practices for the assessment of these qualifications have not yet been fully reflected in the efforts of EU countries to integrate competency-based education into the school curriculum. Assessing core competencies and cross-skills is seen as a challenge, as they refer to complex structures and are not easily quantified. In addition, there is no policy and practice to be used in the measurement and evaluation of basic competencies and skills at a universal level.

However, the PISA exam, which is applied globally and is the OECD's Program for International Student Assessment, is used to measure 15-year-olds' ability to use their knowledge and skills in reading, math, and scientific literacy to cope with real-life challenges.

Moreover, The International Trends in Mathematics and Science Studies (TIMSS) exam administered by the International Association for the Evaluation of Educational Achievement (IEA) primarily focuses on science curriculum standards and measures students' scientific knowledge levels.

1.5. OVERVIEW OF THE TOOLKIT

1.5.3 Explanation of Scientific Literacy and Importance of Measurement and Evaluation

Different definitions of “scientific literacy” can be provided but before giving explanations it is important to define the terms “scientific” and “literacy”. Scientific is a term using experiments or tests involving science; literacy basically means the ability to read and write or knowledge and skills in a specific area. Scientific literacy means “the ability to read and write about something that can be understood using experiments or tests” or “the knowledge and skills an individual has in scientific matters.”

According to CULT Committee-Science and Scientific in the Literacy as an Educational Challenge (2019) report; there are different definitions for the concept of scientific literacy. It is defined as going beyond pure scientific content knowledge by Siarova, Sternadel and Szőnyi (2019). It is also identified as intelligible as the ability to engage with science-related issues and the ideas of science as a reflective citizen in a social context. According to the same report, the concept of scientific literacy consists of five basic elements:

- Fundamental literacy;
- Scientific knowledge and competences;
- Contextual scientific understanding;
- Critical thinking;
- Agency/engagement

Developing students' scientific literacy is an important goal of science education. Scientific literacy has been defined in many ways that emphasize students' ability to use scientific knowledge in real-world situations. For example, the National Research Council (NRC) defines scientific literacy as “the ability to use evidence and data to assess the quality of science information and the arguments put forward by scientists and in the media” (NRC, 2003). Project 2061 (AAAS, 1993) and the Program for International Student Assessment define scientific literacy as “the capacity to use scientific knowledge to identify questions and draw

evidence-based conclusions to help make decisions and understand the natural world and its changes”.

The development of scientific literacy is closely linked to other educational goals, such as increasing media literacy levels, promoting competences for global competence and active citizenship. Therefore, these should be considered in conjunction with various educational initiatives. According to PISA (2018) conducted by the OECD, scientific literacy is defined as an individual's ability to understand scientific concepts, phenomena and processes and to apply this knowledge to new and occasionally non-scientific situations. In other words, scientific literacy is the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen. PISA's definition includes being able to explain phenomena scientifically, evaluate and design scientific enquiry, and interpret data and evidence scientifically. It emphasizes the importance of being able to apply scientific knowledge in the context of real-life situations.

Today's world requires understanding new developments in order to adapt to all areas of life. The rapid development of science and technology and its interdisciplinary structure differentiate the qualities that individuals should have. For example, the science of chemistry no longer develops alone, but advances together with other disciplines such as physics, biology, medicine and technology. Goethe, a German philosopher who lived nearly 200 years ago, said, "Nothing in nature is alone and alone. Everything in nature is connected with the things in front of it, behind it, above it, below it, to its right, to its left" (Ortaş, 2010). The progress of science in an interdisciplinary structure and the complexity of the reflections of this structure on the daily lives of individuals make it difficult for individuals who want to follow developments (Özdemir, 2010). One of the skills that individuals should have in order to follow these developments is scientific literacy.

The concept of scientific literacy is used in the science and technology curriculum, which started to be used in Turkey in 2005, "To educate all students as science and technology literate regardless of their individual differences." with this vision. However, although the concept of scientific literacy is not always used in the same sense in the world (Bybee, 1997), it has been used in the literature for more than sixty years (Gallagher & Harsch, 1997). Norris and Philips (2003) suggest that the concept of scientific literacy consists of the following components:

- To distinguish between scientific and non-scientific knowledge,
- Understanding science and its applications,
- To have knowledge of what counts as science,
- Being independent in learning science,
- Scientific thinking ability,
- Ability to use scientific knowledge in problem solving,
- Necessary knowledge for rational participation in science-based issues,
- Understanding the nature of science, including its relationship to culture,
- Scientific curiosity and desire,
- Information about the risks and benefits of science,
- Thinking critically about science and engaging with scientific expertise.

In the National Education Development Project report submitted to the World Bank by the Higher Education Institution in Turkey, the components of scientific literacy are discussed as follows:

- Being familiar with the natural world,
- Recognizing diversity and unity,
- Understanding key concepts and principles of science,
- Awareness of some important links connecting science, mathematics and technology,
- Understanding that science, mathematics and technology are the products of human efforts,
- Recognizing the strength and limitations,
- Having scientific thinking capacity,
- Using science and scientific thinking for individual and social tools (as cited in Afacan, 2008).

According to the OECD report, scientific literacy does not only include having knowledge about scientific concepts and theories, but also requires knowing what common procedures and practices in scientific matters are and how they develop science.

Therefore, science literacy competencies are summarized as follows:

- Explaining facts, concepts and situations from a scientific point of view,
- Designing and evaluating scientific inquiry method,

- Interpreting data and findings scientifically (OECD, 2019).

While researchers do not yet agree on a single measurable skill set critical to scientific literacy, they unanimously agreed that these skills should include conceptual understanding as well as insights into science and society (Bauer et al., 2007). In the literature, it can be seen that many measurement tools have been developed to measure scientific literacy. However, none of these measurement tools can measure all skills at the same time. Some scales/surveys are measurement tools that measure the definition of science, scientific process skills and basic content knowledge. Others have been developed to test reasoning, critical thinking and cognitive skills (Lawson, 1978; Facione, 1991; Sundre, 2003; Sundre 2008; Sundre et al., 2008; Quitadamo et al, 2008). It is necessary to use more than one measurement tool to measure all skills, which requires effort, time and money. However, current measurements have three main limitations:

- Tends to be domain/discipline specific,
- For students at secondary or university level,
- Ignoring the evaluation of students' motivations and beliefs towards science (Fives et al., 2014)

Conducting a comprehensive assessment of scientific literacy is a challenge, as it is limited by methodological difficulties. However, from the elements of scientific literacy; international large-scale student assessments (such as PISA and TIMMS) and various studies provide useful evidence on scientific knowledge and competencies, attitudes and motivation to learn about science, or the perceived importance of certain science-related topics.

The purpose of PISA and TIMSS exams which are two major international assessments is to measure scientific literacy among students. While TIMSS measures students' level of scientific knowledge by focusing primarily on science curriculum standards, PISA attempts to capture the complexity of scientific literacy by measuring students' knowledge, competencies, contextual science understanding, and critical thinking. It also explores students' attitudes, interests, and motivations for learning science.

For instance; the results of the PISA 2018 published by the OECD showed that one in five students in the EU has low proficiency in reading, mathematics or science. In 2018, the failure rate was 21.7% in reading, 22.4% in mathematics and 21.6% in science. At EU level during 2009-2018, performance in science and reading deteriorated, while math rates remained stable. Using the environment and natural resources as the appropriate context to measure scientific literacy among 15-year-olds in 57 countries, PISA has proven science-specific/discipline-specific measures in the measurement of scientific literacy (Bybee, 2008).

Thus, measuring and assessing students' scientific literacy is extremely important because it demonstrates how students can develop knowledge involving the processes of science and scientific research. Scientific skills require not only knowledge of science but also an understanding of the characteristics of science. Scientific literacy is a prerequisite to be able to adjust to the tasks of a promptly altering world. This attention brings scientific literacy into line with the development and growth of life skills. It distinguishes the requirement of intellectual skills in a social setting, and further, this vision distinguishes that scientific literacy is for all of us.

1.5. OVERVIEW OF THE TOOLKIT

1.5.4 Recommendations and Tips for Effective Measurement and Evaluation

Research shows that there is no single best practice method and no universal combination to fully measure and evaluate core competencies and transversal skills. In this context, there is an understanding that various methods and types of assessment should be used to comprehensively assess various skills. Therefore, the effectiveness of a method is thought to depend on its purposes and design as well as on the capacity of schools and teachers to use it.

Performance-based assessment, which has the potential to measure and develop broad competencies and high-level skills, covers different assessment techniques and integrates a feedback mechanism. Focusing on students' personalized needs, clear definitions of learning objectives and timely feedback are considered key strengths of performance-based assessment.

Because of their collaborative nature, peer and self-assessment can be effective in providing deep learning and self-evaluation of students, and can also provide an integrated assessment framework to other assessment and assessment practices to be used in the classroom. Research shows that peer and self-assessments are particularly useful in developing transversal skills such as critical thinking, creativity, problem solving, risk assessment, as well as non-traditional competences such as initiative and entrepreneurship, learning to learn, and social competence.

In addition, the use of ICT in assessment and evaluation can make assessment faster and more effective, while helping to find effective solutions for the assessment of non-traditional qualifications and offers opportunities to change the way qualifications are assessed.

The Italian government has stated by Legislative Decree 74/2017 that each public administration is required to measure and evaluate performance with reference to

- The administration as a whole;
- The organizational units or areas of responsibility in which it is divided;
- The individual employees for the purpose of improving the quality of the services offered,

as well as the growth of professional skills, through the enhancement of merit and the disbursement of bonuses for the results pursued. Also schools have undergone the same standard so what is now called the Performance Plan is the tool that initiates the performance management cycle.

It is a three-year programmatic document in which, in line with the resources assigned, the objectives, indicators and targets on which the measurement, evaluation and reporting of performance will then be based are explained.

The Plan is drawn up with the aim of ensuring compliance with the following principles:

- Transparency
- Truthfulness and verifiability
- Participation
- Internal and external coherence

The Plan is drawn up with limited dimensions, as it must also be easily understood by external stakeholders (users, suppliers, citizens, trade associations, etc.). The reference time frame of the Plan is three years, with a breakdown into annual objectives, according to a flow pattern. The structure of the document must allow comparison over the years with the performance report.

MEASUREMENT AND EVALUATION APPROACH AND TYPES

1.6. MEASUREMENT AND EVALUATION APPROACH AND TYPES

Assessment of 21st century skills may require different approaches from those that have dominated assessment systems until now. For example, multiple-choice; short, constructed-response; or essay tests may not prove sufficient for measuring many of the21st century skills, such as the interpersonal skills of teamwork, collaboration, leadership, and communication, or some of the hard to measure cognitive skills, such as creativity, or some of the intrapersonal skills (self-regulation, time management, and adaptability). Current educational measurement science might fail in measuring such skills in a reliable and valid way.

Modern education requires the design of a new evaluation framework and a new reference system based on the training of students' skills. The range of assessment methods used by teachers in the classroom has expanded, insisting on using traditional methods (assessments, written, practical tests, etc.) together with new, modern ones (portfolio, project, investigation, self-evaluation, etc.), which in fact present alternatives in the current context, when there is an insistence on shifting the emphasis from the evaluation of learning products to the evaluation of the student's cognitive processes during the learning activity.

As a first step the objectives that an ideal form of assessment should fulfil have to be outlined; bearing in mind that assessment should:

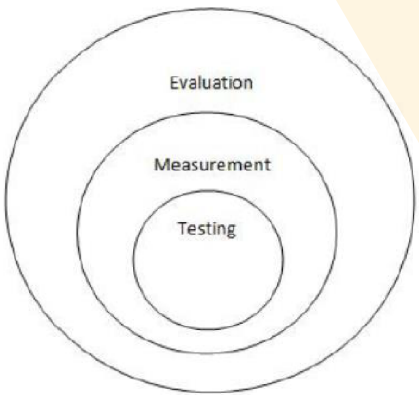
- Measure learners' knowledge, application and learning of 21st century skills, and identify where intervention is required;
- Be applicable across a wide range of instructional programs
- Allow learners to demonstrate their proficiency in 21st century skills to educational institutions and prospective employers

A set of different assessment tools are needed as a single assessment instrument cannot meet all these objectives. In fact, assessment methods need to embrace process-result oriented and summative-formative oriented assessments and move beyond traditional standardized tests.

1.6. MEASUREMENT AND EVALUATION APPROACH AND TYPES

1.6.1 Process and Result Oriented Evaluation Approach

Measurement and evaluation are used to explain how the progress of learning and the learning outcomes of students are assessed and continue to dominate educational practice around the world (Adom, Mensah & Dake, 2020). They can be seen as a component of the evaluation as shown in Graphic 3.



Graphic 3. Lynch's model of evaluation, measurement, and testing (Lynch, 2001)

Graphic 3 shows the inter-related constructs of evaluation, measurement, and testing. As understood from the figure measurement and testing can be seen as a component of the evaluation. In education tests are the most commonly used assessment tools and are used to systematically measure a sample of behaviour by posing a set of questions (Linn, 2008). Tests measure quality, ability, skills and knowledge and are used to determine the student's ability to complete certain tasks or demonstrate mastery of a skill or knowledge of content (Adom, Mensah & Dake, 2020).

Measurement means quantifiable the data by using one or more instruments such as a test or rating scale (Adom, Mensah & Dake, 2020). Educational measurement involves the assignment of a numerical index and is used to measure the physical qualities and educational qualities of a person such as height, weight, intelligence, abilities, etc. Educational measurements are complex and expressed in grades or marks (Kolluri, 2021).

Evaluation refers to making a judgement or determination of the quality or worth of an object, subject or phenomenon (Adom, Mensah & Dake, 2020). Evaluation is an integral part of the educational process. Teachers' responsibility is to conduct tests or examinations, to understand the evaluation types and their use. The evaluation assesses the overall personality of a child which is a quantitative as well as a qualitative description of pupils' achievement (Kolluri, 2021).

The essential aspects of evaluation were mentioned as follows (Kellaghan & Stufflebean, 2003; Kolluri, 2021; Weir & Roberts, 1994):

- Evaluation is a continuous process which is associated with objectives and implementations which is much more than determining the outcome of learning, it is rather a way of gauging learning over time. They are always evolving and developing.
- It is a comprehensive process. It is not only concerned with the determination of learning results and course of action, but also recommends for the improvement of the child, society, nation and mankind.
- A comprehensive program of evaluation involves the use of many procedures, tests and techniques. Therefore a variety of evaluative tools is necessary to provide the most accurate assessment of students' learning and progress.
- Evaluation is a cooperative activity involving the principal, teachers, students and parents. Students must be able to assume an active role in evaluation so they can begin to develop individual responsibilities for development and self-monitoring
- Evaluation is both quantitative and qualitative.
- Evaluation needs to be authentic that must be based on the natural activities and processes students do both in the classroom and in their everyday lives.

The process-oriented evaluation approach makes the individual more effective in the process, based on the constructivist approach to the work process (Shepard, 2000). Process-oriented measurement and evaluation is a measurement and evaluation approach that is frequently used in education programs based on the learning process and structured according to the constructivist learning approach. In this context, it is an approach that measures and evaluates the student's progress in cognitive, affective and psychomotor dimensions. In this approach, the aim is not only to evaluate the student by grade; it is also to give feedback to both the student and the teacher about their deficiencies and the progress of learning. Process-oriented assessment approach can be defined as an approach that organizes necessary improvement studies and measures by determining which information they have learned and which they have not learned, rather than determining how much learners have learned (Ekici Calın, 2019).

The measurement method, measurement tool or scale to be used should be determined according to the type of acquisition or skill to be measured. The repetitiveness of educational activities and practices, the effective conduct of visibility studies and the active participation of individuals in the process necessitate the dominance of process-oriented evaluation (Kırnık & Altunkaynak, 2019).

In the draft programs of the TR Ministry of National Education (2017), *"Constructive feedback about their performance after the evaluation; It will enable students to comprehend what is essentially, what is being taught, and in which area they should strive to improve*. This shows that process evaluation is an important step for individuals to realize themselves.

In general, the items of the process-oriented assessment approach in problem-based learning can be explained as follows (Barrows, 2002):

- Learners are monitored continuously throughout the education process.
- Students are guided in tasks that require the use of tools and materials.
- Learners are assisted in organizing the new knowledge they have created and the solutions they have developed originally.

In order to increase the motivation of individuals, a scoring key is prepared and its content is shared with the learners and frequently reminded throughout the process. Students are given scenarios that are compatible with real-life problems, and their ability to overcome difficulties and troubles is developed. By making measurements in accordance with scenarios based on real life problems, the evaluation phase is connected with real life.

While the process is examined and evaluated as a whole, both the students' status in the learning process and their level at the end of the process should be measured. This measurement work is generally carried out with a wide variety of evaluation techniques such as observation forms, student files, product file, rubrics, self and peer evaluation, project, observation forms, and tests or written exams as a result of the process (Albanese & Hinman, 2019).

Advantages of Process-Oriented Evaluation Approach

- The development process of the student can be closely monitored and appropriate guidance can be made.
- Thanks to the feedback received from the students, the applied methods and techniques can be reviewed and the desired changes can be made.
- Problems that hinder learning can be easily identified.
- It is suitable for gradual and continuous development.
- Students' achievements can be evaluated from a broad perspective.
- Students can observe their own achievements.
- It can reduce anxiety while increasing motivation.

- Mistakes are prevented by detecting student mistakes early.
- Individuals learn by themselves.
- As a result, it is not dependent on a single test or measurement, so its validity and reliability are high.

Disadvantages of Process-Oriented Evaluation Approach

- It is a continuous and repetitive assessment and evaluation approach.
- Teachers need both a lot of time and a lot of effort.
- The application steps are tiring.
- The application process requires expertise.
- It requires "objectivity" in the evaluation stages.

When a general evaluation is made in the process-oriented evaluation approach, it is seen that the advantages are more dominant than the disadvantages. The individual's self-learning, which is considered the most important result in the teaching process, finds an opportunity in this evaluation process. The most striking negativity among its disadvantages is that it is teacher/teacher oriented. Teachers need to spend a lot of time and effort in this process.

According to the result-oriented evaluation approach, learning objectives and learning-teaching processes are predefined by teachers (O'Neill, 2015). According to the model, the basis of the approach is to emphasize the goals, the needs and orientations of the learners can be ignored, and the decisions about learning are determined by the teacher. While results-oriented models generally see curriculum development as a technical task, they include transparent, measurable, observable and comparable learning outcomes (Meyers & Nulty, 2009).

In the result-oriented assessment approach, in order to achieve comparable results for all participants at different times and by different people applying the exam or assessment:

- Process instructions should be fixed by the organizers of the training activity
- The measuring instrument and its scoring should be fixed

- It should be applied and scored in the same way (Enger & Yager, 1998).

Using the same kinds of measurement tools and methods in the measurement and evaluation process sometimes may not provide the targeted outputs for evaluation.

It is necessary for learners to use both result-oriented and process-oriented assessment techniques, and a wide variety of measurement tools in accordance with individuals, taking into account the developmental characteristics suitable for their age groups. Thus, they can identify individuals' lack of acquisition, mislearning, and faulty aspects of the program with feedback (Ekici Calın, 2019). Thanks to this feedback, necessary improvements and arrangements can be made and the curriculum can gain functionality. In addition, when using process-oriented and result-oriented program approaches, it should not be ignored that there may be differences according to many steps such as the type, department and subject area of the course (Mızıkacı et al, 2019).

When results-oriented assessment approaches and process-oriented learning approaches are compared:

Result-Oriented Evaluation Approaches	**Process-Oriented Learning Approaches**
Focuses on product-based measurement and evaluation	Considers measurement and evaluation throughout the process
The learning process is at the end	It is throughout the process
Teaching is based	It is learner based

Table 1. Result and Process Oriented Evaluation Approach (Tatar, Korkmaz & Ören, 2007).

1.6. MEASUREMENT AND EVALUATION APPROACH AND TYPES

1.6.2. Formative and Summative Evaluation

There are two main types; formative and summative evaluation. The concept of modern evaluation as an integral part of the learning process is that of "formative assessment". This concept establishes assessment as a means of training the student and allows observing the evolution of his skills.

Formative education is used during the planning and designing phase of an educational programme (Adom, Mensah & Dake, 2020) which is made by the teacher during teaching learning process in order to know about learners' progress learning process (Kolluri, 2021). Researchers stated the purpose of formative assessment is to identify the steps required to achieve learning goals and to encourage "learning by understanding" through continuous monitoring of acquired skills (Harlen & James, 1997). Effective formative assessment is designed to achieve desired learning goals and focuses on daily needs and practices. It is intended to monitor student achievement and progress in achieving desired goals, so it should be precise, clear, measurable and based on Bloom's Taxonomy (Trumbull & Lash, 2013). Examples of formative education are asking questions during classroom teaching, classroom assignments, home assignments, informal interviews with students etc. (Kolluri, 2021).

The formative assessment approach is a part of the teaching process (Tekin, 2016; Senemoğlu, 2007). It contributes to the success of teaching with elements such as feedback, reinforcement, correction, hint and student participation, which are included in the education process and determine the quality of teaching (Atılgan, 2017). According to this approach, evaluation work can be done after each step, subject, unit or achievement.

The main purpose of formative assessment, which is a natural part of learning-teaching processes and one of its main variables, is not to give grades or points to students (Tekin, 2016). This main factor and variable can provide an increasing effect on learning in every application in the process (Bahar et al., 2015; Özçelik, 2013).

In the formative assessment approach:

- The first step is to check whether the students have learned the determined target behaviours and achievements.
- The second step is to determine to what extent learning has taken place if the individual has not acquired the predetermined target behaviours and achievements.
- The third step is to determine the learning goals and achievements of individuals in order to organize their teaching practices.

- In the final step of the formative assessment, the level of success of the individual in a course is monitored, it is determined whether the goals have been achieved sufficiently, and feedback is given to the student and the teacher.

Formative assessment provides concise and guiding feedback on whether educational studies achieve expected learning in the ongoing learning process (Mantz, 2001). It provides the opportunity to continuously control the learning levels of the learners during the education process. It can clearly identify the deficiencies, mistakes and learning difficulties of individuals in their learning. Since it is student-centred, it enables individuals to develop positive attitudes towards the curriculum (Hotaman, 2020).

There are many positive effects of formative assessment. These are (Adom, Mensah & Dake, 2020; Baht & Bhat, 2019; Boulmetis & Dutwin, 2005; Kealey, 2010; Kolluri, 2021):

- Provides immediate feedback to teacher so that he/she can modify and improve instruction
- Provides feedback to students enable them to identify their learning errors and rectify them immediately
- Facilitates retention and transfer of learning
- Enables the teacher to readjust his teaching according to the needs of students
- Gives more importance to students' achievement or their learning
- Helps in designing remedial teaching by providing data of student's performance regularly
- Helps to determine the programme strengths and weaknesses
- Helps to students to modify their behavior after getting feedback from this evaluation
- Provides soliciting immediate feedback for the given programme
- Gives reinforcement to high achievers
- Works as a self-evaluation device for learners
- Enables students to take responsibility for their learning and encourages active learning
- Reduces anxiety by providing learning guidance

Suggestions for Formative Assessment

- Keep clear criteria for what defines good performance.
- Encourage students' self-reflection.
- Give students detailed, actionable feedback.
- Encourage teacher and peer dialogue about learning (Available here: https://poorvucenter.yale.edu/SmallGroupFeedback)
- Encourage positive motivational beliefs and self-esteem.
- Provide opportunities to bridge the gap between current and desired performance.
- Gather information that can be used to help shape teaching.

- Making learning outcomes specific can help tailor learning and assessment practices.
- Defining core competencies as detailed and concrete learning outcomes ensures consistent assessment practices.
- Portfolios, holistic scoring rubrics, and formative feedback can be helpful in tracking and reformulating goals, monitoring student progress, and assessing broad competencies.

Tools and Techniques That Can Be Used in Formative Assessment

- Worksheets
- Product file (Portfolio)
- The student product file (portfolio) is a collection of students' achievements in one or more areas, showing their work, effort, and stages. In particular, portfolios for evaluation include all the records that the teacher needs to evaluate the student and may include more comprehensive assessment data for the student (Gürel, 2013).
- Performance-based evaluation
- Concept maps
- Rapid techniques that can be used for formative assessment
- Grade Point Key (Rubric)
- It can be examined to arrive at various rubrics:
  https://www.schrockguide.net/assessment-and-rubrics.html

  https://www.teach-nology.com/web_tools/rubrics/

- Observation form
- Checklist
- Self, peer and group assessment tools
- e-Assessment
- Exit vouchers/tickets: It is a tool to measure whether students understand or understand what they have learned in the lesson. It can be applied sometimes at the end of a topic/unit or sometimes at the end of the lesson. It can provide guidance to teachers in arranging or arranging instruction to best meet student needs. To design an exit slip/ticket, see:
  https://www.edutopia.org/practice/exit-tickets-checking-understanding

The term summative means the summing up of all the available information, in other words it means “addition of all things”. In this respect summative evaluation is made at the end of the term, semester, course or instructional program to assign a grade for learners. It is the kind of evaluation that summarizes the strengths and weaknesses of a programme (Adom, Mensah & Dake, 2020). Examples of summative education are unit tests, quarterly examination, half yearly examinations, semester examinations and annual examinations (Kolluri, 2021). PISA’s assessment of high school students’ ICT literacy through various activities is also one example of summative assessment on a global scale.

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Summative assessments, which is also called assessments of learning focus on making judgments about how well individuals do at the end of a programme (Ecclestone, 2010). The purpose of this assessment is to evaluate the student's learning at the end of a teaching unit by comparing it to some standard or criterion. The summative evaluation provides a baseline benchmark for checking the progress of the educational program of students, institutions, and the country as a whole. If assessment results show gaps between student knowledge and learning objectives, new curriculum planning can be undertaken. For these reasons, summative evaluation is important. Standards-oriented teaching plays an important role in the current education system. Summative assessment, therefore, provides a basic benchmark for checking the progress of the educational program of students, institutions and the country as a whole.

It is done with the aim of providing data to determine the acquired behaviours, characteristics and skills of the learners at the end of the training program process (Demirel, 2000). It is done to measure the student's success in a course or more than one course with grades. It mostly consists of exams held at the end of the unit, at the end of the semester or at the end of the year, rather than the end of the subject (Bulunuz & Bulunuz, 2013). Based on students' numerical results, decisions can be made about the success of individuals (Tekin, 2016).

It is an evaluation that is generally made at the end of a training such as a module, semester, activity, internship, etc., to measure the behaviours, characteristics and skills that individuals are thought to have acquired (Dinçer, 2016). The success of the student is measured and documented with a score, and student rankings are made according to the score obtained (Keeley, 2008). Midterm and final exams in universities, written and oral exams in primary, secondary and high schools, high school entrance exams, university entrance exams, and internationally applied exams such as PISA and TIMMS can be given as examples of level-determining assessment (Tan, 2010). These national or international exams also determine the national or global levels of individuals.

There are many positive effects of summative assessment. These are (Baht & Bhat, 2019; Adom, Mensah & Dake, 2020; Kolluri, 2021):

- Makes academic records
- Gives an overall picture of student's performance
- Helps in determining the extent to which the objectives have been achieved
- Helps in determining the success of methods used for training programs used
- Helps the teacher improve teaching procedure, planning and organizing further teaching
- Helps to find out weak areas where the results are steadily low
- Provides certificate on completion of the course or provide a periodic report to parents
- Follows certain strategies for evaluation by means of assignments, tests, projects and more

- Assists the individuals and offers them an opportunity to develop a learning environment

There are some differences between formative and summative evaluation. These are given at below (Aghazadeh, 2019; Bennett, 2011; Ecclestone, 2010; Kolluri, 2021).

- Formative evaluation is a continuous process as it is conducted during teaching learning process whereas summative evaluation is terminal as it is conducted after completion of the program or course of study.
- Formative evaluation is child centred whereas summative evaluation is objective centred.
- The main purpose of formative evaluation is to provide immediate feedback to the teacher as well as to the students to improve their respective tasks. Summative evaluation is intended to find out the general status of the students and to assign grades or certify them.
- Tools of formative evaluation are daily assignments, observation and interviews etc. Periodical tests and projects are tools of summative evaluation.
- Formative evaluation is means of interaction between teacher and students, whereas summative evaluation develops interaction between school and community.
- Evaluation used for summative purposes emphasizes reliability and accountability, assessing a limited number of performances and contexts. On the other hand, the formative purpose of evaluation emphasizes overall validity, assessing more performances in a wider range of contexts.
- Summative evaluation is considered assessment of learning. On the other hand, formative evaluation also defined as an assessment for learning, emphasizes evaluating learners' progress during the process of learning.

The Table 2 also summarizes the differences between formative and summative evaluation.

Evaluation Types	When to use	What it shows	Why it is useful
Formative Evaluation **Evaluability Assessment** **Needs Assessment**	During the development of a new program.	Whether the proposed program elements are likely to be needed, understood, and accepted by the population you want to reach.	It allows for modifications to be made to the plan before full implementation begins.
	When an existing program is being modified or is being used in a new setting or with a new population.	The extent to which an evaluation is possible, based on the goals and objectives.	Maximizes the likelihood that the program will succeed.
Summative-Outcome Evaluation **Objectives-Based Evaluation**	After the program has made contact with at least one person or group in the target population	The degree to which the program is having an effect on the target population's behaviors.	Tells whether the program is being effective in meeting it's objectives.

Table 2. Differences Between Formative and Summative Evaluation (CDC-Program Operations Guidelines for STD Prevention)

In the 21st century the important thing is the learning process. Education environments must let the students actively learn by doing and construct their knowledge. For this reason, teachers need to focus on the improvement of learners' thinking skills, ability to do research, and ability to access, summarize, analyze and synthesize information and technologies to apply problem-solving skills (Junpho, 2015). In order to ensure students' progress in 21st century skills, both summative and formative assessments need to be available to evaluate their performance (Koenig, 2011). Therefore educators need to be aware of how to adopt plural measurement methods to get better suit specific classroom needs and meet the educational challenges in assessing 21st century skills (Greenstein, 2012).

In relation to formative assessment, teachers must use a variety of methods and means such as observation, questionnaires, brainstorming for final consideration of specified topics, portfolio, practical works, prior knowledge tests, self-assessment, peer review and rubrics. In relation to summative assessment evaluation is made at the end-of-unit or end-of-course to grade, giving points or certification of passing the course or passing the curriculum or getting a promotion.

Aghazadeh (2019) summarizes the methods used to assess 21st century skills. These methods are shown in Table 3.

Skill	Assessment Methods
Creativity	Self-report
	Game-based assessment
	Performance task
	Project based performance rubrics
	Computer-based assessment
Critical Thinking	Performance task
	Project based performance rubrics
	Game-based assessment
	Multiple methods
Communication & Collaboration	Questionnaire
	Portfolio & Performance task
	Performance task
	Computer-based Assessment & Performance
	Game-based assessment
	Multiple methods
Problem-solving	Computer-based Assessment & Performance
	Game-based assessment
ICT literacy	Questionnaire
	Computer-based Assessment
Global awareness/ Citizenship	Questionnaire
	Performance task
	Game-based assessment

Table 3. Some Examples of 21st Century Skills Being Assessed By Different Methods (Aghazadeh, 2019).

Table 3 shows that to measure the creativity skills self-report, game-based assessment, performance task, project based performance, rubrics and computer-based assessment; to measure the critical thinking skills performance task, project based performance rubrics, game-based assessment, multiple methods; to measure the communication and collaboration skills questionnaire, portfolio and performance task, performance task, computer-based assessment and performance, game-based assessment, multiple methods; to measure problem- solving skills computer-based assessment and performance, game-based assessment; to measure the global awareness/citizenship questionnaire, performance task, game-based assessment are used.

PRACTICAL TOOLS IN VARIOUS MODERN TEACHING MODELS

1.7. PRACTICAL TOOLS IN VARIOUS MODERN TEACHING MODELS

1.7.1 Measurement And Evaluation Techniques And Tools That Can Be Used in Formative Assessment

1.7.1.1 Worksheet

Worksheets; which can also be called exercise sheets or transaction sheets, are assessment tools that are frequently used in education (MEB, 2020). It should be prepared according to the age and grade level of the students and the gains in the curriculum should be taken into account.

The steps of preparing the worksheet and the points to be considered in the process;

- Goals are determined in accordance with the achievements given in the curriculum.
- Students' roles and responsibilities should be determined.
- It should be determined whether the study will be done individually, in a group or in pairs.
- Different types of questions should be included.
- The success of students at different levels should also be taken into account.

a) Directive

- Instructions and questions should be in a specific order and numbered.
- Words and expressions suitable for students should be chosen.
- Expressions to be emphasized should be written in bold or italics.

b) Diagrams, graphics and visuals

- Color images should be selected.
- Must be suitable for student level.
- Images should be briefly explained.

c) Page layout

- A design must be made.
- Should be divided into understandable sections.
- Titles should be given to each section.
- Each section and page should be numbered.
- Should be interesting.
- Different fonts should be used.

d) Pre-trial

- It must be filled in by the teacher and an answer key must be prepared.
- It should be applied to a few different students and opinions should be taken.
- It should be reformatted according to the feedback.

Preparing questions for the worksheet;

Worksheets can be used to measure cognitive, affective and psychomotor characteristics of individuals as well as being a measurement and evaluation tool.

a) Short Answer and Fill in The Gap Questions

Short answer questions are a type of question that can be answered using a word, phrase, sentence, number, sign, or symbol. Short-answer question statements consist directly of the question. Fill-in-the-blank questions consist of incomplete sentences. The student is expected to fill in the blank with the appropriate expression.

b) True/False Questions

It is based on the checkbox method to determine the accuracy of statements, definitions of terms and explanations of facts and principles.

c) Matching Questions

It is based on matching sentences, words, numbers and symbols in parallel columns on the same page with words, sentences, numbers or expressions in the other column. It is based on the ability to establish a relationship between two subjects.

d) Multiple Choice Questions

It consists of a problem statement and a listed solution statement. Students are expected to read the root of the question and mark the appropriate option.

e) Open-Ended Questions

Students are expected to be able to express their own ideas in original words. Open-ended questions are used to assess high-level mental/cognitive skills.

f) Concept Maps

Concept maps are two-dimensional diagrams in which the relationships between concepts belonging to the same subject are expressed with visuals.

g) Fishbone Diagrams

Fishbone diagrams are also known as cause-effect diagrams, Fishikawa or Ishikawa diagrams. It is shaped like a fish bone. It is a cause-effect discovery tool that helps to find the causes of errors or failures in the educational process and to produce solutions.

h) Puzzles

It consists of horizontal and vertical tiles. The word or group of words corresponding to the given sentence should be placed in the boxes, letter by letter. There are horizontal and vertical intersections on a letter basis. Thus, simple clues are given to the student.

i) Shape Labeling

The student is expected to match and select the listed figures with the given expression.

j) Figure Drawing

The student is expected to draw figures related to the given expression. The individual tries to express himself with shapes.

k) Completing or Drawing a Graphic

The student is expected to draw a graph about the given expression or complete the missing graph.

1.7. PRACTICAL TOOLS IN VARIOUS MODERN TEACHING MODELS

1.7.1 Measurement And Evaluation Techniques And Tools That Can Be Used in Formative Assessment

1.7.1.2 Product File (Portfolio):

It collects and records the products of the students in the process. It is created for gains and goals. The portfolio may include providing students with some basic skills, developing self-assessment and peer assessment skills. In particular, it provides effective reflection in the measurement and evaluation of achievements in the dimension of skills and attitudes. It gives students the opportunity to reflect and comment on their products in the process (MEB, 2020).

Preparing an Effective Product File

- The aims and learning objectives of the product file should be explained to the students participating in the teaching process.
- Students should be involved in the process.
- The works to be included in the product file should be in the content that can reflect the student performances in the most effective way.
- Material selection principles should be determined and clearly explained to the students beforehand.
- Evaluation criteria of the studies selected by the students should be determined (Kan, 2007)

Product File Development Steps

There is no standard and single right way to develop student product files. It may vary according to many factors such as grade level, age level, course, subject.

a) Organizing and Planning Phase

- The scope and purposes of the product file should be determined.
- The product file evaluation calendar should be determined.
- Scoring criteria and standards should be developed.
- Evaluators need to be trained.
- A scoring key should be prepared for the evaluation of product files.
- It is necessary to report the results in accordance with the stakeholders (Kan, 2007).

b) Accumulation Phase

- When selecting products and documents in the product file,
- Subjects worked on in the process,
- The number and duration of the learning process stages,
- Whether there are special works or not,
- The scope and depth of the examined and predetermined themes,
- The criteria to be used in the evaluation of the products (Erdoğan, 2006) should be considered.

c) Reflection Phase

Students are expected to reflect on what they have learned in different ways and in different places such as learning records and reflection diaries (Erdoğan, 2006).

Product File Types

a) Development/Process Product File

It is a tool that records the progress of students in academic, skill, etc. areas for a certain time period such as a semester or an academic year.

b) Best product/showcase product file

It is a product file consisting of the products that the student thinks reflects himself/herself best.

Reasons for Using Product File

a) Developing Multiple Intelligences

It enables individuals with different cognitive and affective abilities to find opportunities to express themselves. It allows us to show the different intelligence structures of individuals.

b) Disadvantaged Students

It allows individuals with different disadvantages to creating files according to their own situations.

c) School-Family Cooperation

While the individual gives information about the family with the product file, at the end of the process, the family has information about the individual's development status and school.

d) Self-Assessment

Individuals include their best work in product files. Thus, they can see their own shortcomings and correct their mistakes with self-control in the process.

1.7. PRACTICAL TOOLS IN VARIOUS MODERN TEACHING MODELS

1.7.1 Measurement And Evaluation Techniques And Tools That Can Be Used in Formative Assessment

1.7.1.3 Performance Based Evaluation

Performance-based assessment is a set of practices based on the student's use of the knowledge, skills and experiences they think they have to reinforce their learning and create a product suitable for daily life problems (Başol, 2015). Performance-based assessments are activities that develop and measure individuals' high-level thinking skills (Kutlu et al., 2017).

Two types of performance-based evaluation can be made;

a) Performance Based Evaluation with Limited Response

It is an assessment that is usually carried out in the classroom environment and under the supervision of a teacher. It is not long-term and does not require data collection. Examples of activities such as filling in dumb maps, creating tables and graphics, and completing the unfinished story can be given (MEB, 2020).

b) Performance Based Evaluation with Unconstrained Response

It is a long-term (for example, a week-a month) evaluation on any predetermined subject, based on problem solving and includes steps such as information gathering, analysis and arrangement (Kutlu et al., 2017). For example, they are activities carried out during environmental awareness studies and cultural heritage studies and transferring them to the future.

Performance evaluation has two aspects: product and process. While the product is what the students produce, the process is the activity that the students do while creating the product (Göçer, 2014).

Performance-based evaluation activities consist of four main parts (Alıcı, 2017):

Describing

It is necessary to give all general information about the task assigned to the student.

Task

The student should be given problem tasks to solve in the process.

Instruction

It is necessary to give instructions to the students while performing the tasks.

Scoring

The tools and methods to be used in the evaluation of students should be determined in advance in accordance with the purpose.

1.7. PRACTICAL TOOLS IN VARIOUS MODERN TEACHING MODELS

1.7.1 Measurement And Evaluation Techniques And Tools That Can Be Used in Formative Assessment

1.7.1.4 Concept Maps

Concept maps are a learning and teaching strategy that shows the relationship of a broad concept with its sub-concepts. It shows how the learners should establish a connection between the concepts that are planned to be learned about the subject and these concepts (Demirel, 2002). This relational map can be drawn individually (Kaptan, 1998).

Purposes of using concept maps

- Students can classify information, thoughts and attitudes about key concepts on maps.
- Students can establish relationships between concepts.
- It can be used as a learning tool in education and training activities.
- It can be used in problem solving and evaluation studies.
- It shows how the student relates the given concepts.
- Reveals and showcases students' ability to relate.
- They are designed to cover the lowest and highest concepts.
- It shows how the student who created the map synthesized the concepts thanks to the established relationships (MEB, 2020).

Types of concept maps

a) Hierarchical Concept Maps

They are concept maps in which the information about the subject is classified from general to specific. It should be prepared in a way that can show the concepts in a systematic way.

b) Non-Hierarchical Concept Maps

They are concept maps in which the main concept is in the centre and the secondary concepts spread from the central concept of the map to the periphery. If there are sub-concepts, a map is created similarly.

c) Chain Concept Maps

Concepts are arranged sequentially in a chain relationship. It can be used to show the steps of the process. It includes the main concept and sub-concepts.

Benefits of using concept maps

- It allows synthesizing information.
- It helps them retain information for a longer period of time.
- It allows an easier understanding of conceptual relationships between information.
- It reduces the anxiety levels of students (Okebukola and Jedege, 1988).
- It helps their assessment at the level of understanding.
- It enables the development of high-level mental skills such as categorizing, combining, producing, elaborating and analyzing (Jonassen et al., 1993).
- It helps individuals to learn meaningfully.

Usage areas of concept maps

- Facilitating the learning of individuals during the processing of the subject,
- Controlling the learning and teaching process,
- Revealing possible misconceptions,
- Using the evaluation process during or at the end of the course (MEB, 2020).

The development process of concept maps

Different concept maps can be created when the learning situation of each individual may differ. While preparing concept maps, the following stages can be followed in general:

- All concepts of the subject to be taught in the relevant lesson are listed on the board in a way that every student can see.
- The most general concept or the most comprehensive concept is placed at the top.
- Equal/similar concepts or concepts with the same meaning are placed on the same line.
- Other concepts in the list are ordered in descending order of their generality and scope.
- A line is drawn between the two concepts to show the relationship established between the two concepts that are thought to be related.
- The statement showing the relationship between the two concepts is written briefly on the line with a few words.
- If it is important to indicate the direction of the relationship between the concepts, the direction showing the relationship is shown with an arrow (MEB, 2020).

Points to be considered in the application of concept maps

- Concept maps that seem too complex should not be created.
- In order to show the relationship between the two concepts, the most appropriate linking phrases/words should be preferred.
- Each concept related to the subject should be written only once in the concept map.
- Every concept must be associated with at least one other concept.
- While creating the concept map, the grade level and the characteristics of the subject should be taken into consideration (MEB, 2020).

Use of concept maps in assessment

Concept maps can be used for evaluation before, during and after learning according to the characteristics of the subjects and courses. There are many different ways of creating concept maps due to individual differences. In this respect, there is not only one truth in the evaluation. Students should not be graded directly according to their status, but written feedback should be given first. The places where students are stuck and where their learning is lacking may not be detected individually and deficiencies can be eliminated with individual feedback (MEB, 2020).

Concept maps made by students can be evaluated by scoring in different ways. Scoring and evaluations can be made by considering the "Number of concepts, links, hierarchy or rankings, cross-links and indicator arrows, examples and explanation statements" on the map.

1.7. PRACTICAL TOOLS IN VARIOUS MODERN TEACHING MODELS

1.7.1 Measurement And Evaluation Techniques And Tools That Can Be Used in Formative Assessment

1.7.1.5 Rubric

Rubrics are measurement and evaluation tools that enable individuals to determine the proficiency level of their performance by grading them with one of the pre-prepared and scored criteria or criteria. One way to break out of the limitations of traditional scoring is to use a rubric. It is known as a scoring method that can be used with different assessment tools such as rubrics, portfolios, worksheets, and performance-based assessments. Since the possible performances of the students in the rubrics are clearly defined by their sub-indicators, the level of the student's performance can be clearly determined. Thus, individual feedback can be given to each student (MEB, 2020).

Benefits of Using Rubrics

- Evaluation is more objective and more consistent
- Individual feedback can be given in a systematic way,
- The criteria are clearly stated and can be shared,
- Individual development can be documented (MEB, 2020).

Preparing a rubric

- There are two kinds of rubrics used in the classroom environment: holistic rubric and analytic rubric. The two rubrics differ in the detail they deal with.
- While there is only level determination with general evaluation and review in the holistic rubric, levels are determined with more than one sub-performance indicator and separate explanations for each of them in the analytical rubric. In other words, the analytical rubric includes more than one holistic rubric (MEB, 2020).

Types of rubrics

a) Holistic rubric

The main purpose of the teacher in this rubric should be to provide an overview of the entire learning process. It can be used in subjects that do not require details and in the evaluation of general skills. It can be used to evaluate the ideas, solutions, productions and presentations of individuals regarding the relevant course or subject in the classroom (MEB, 2020).

b) Analytical rubric

When the student needs to perform in complex and different content based on more than one criterion related to the course topic, levels are determined in advance for each content and all of them are placed on the analytical rubric as a whole. In this way, space and time are allocated for each criterion (MEB, 2020).

Use of rubric

Rubrics can be used in conjunction with different formative assessment tools (such as portfolio, performance-based assessment, open-ended question scoring, or artistic creation). Therefore, it can be used with a wide variety of assessment tools.

- While developing the rubric, the learning objectives to be evaluated should be determined first.
- In line with these goals, the knowledge, skills, attitudes and behaviours expected to be seen in the student should be determined.
- In order to score the student behaviours determined and to be observed, a holistic rubric should be used if a general evaluation is to be made, and an analytical rubric should be used if a detailed evaluation is to be made.
- Behavior should be clearly expressed and concrete examples should be developed for each level to be used in the rubric, in accordance with the relevant subject.
- The rubric, which was prepared in advance and developed in accordance with the subject, should be shared with students and all stakeholders (MEB, 2020).

Give feedback on the rubric

In rubrics, the criteria are prepared by scoring in advance. The student's possible performances are defined at appropriate levels for each indicator. These descriptions and boxes also provide concise and clear feedback. When the graded rubric is applied, the student will see what grade he is in and will read the description of that grade and get feedback. This rubric and feedback will enable them to interact quickly with the student, parents and all stakeholders (MEB, 2020).

1.7. PRACTICAL TOOLS IN VARIOUS MODERN TEACHING MODELS

1.7.1 Measurement And Evaluation Techniques And Tools

That Can Be Used in Formative Assessment

1.7.1.6 Observation Form

- Observing is a very old method of gathering information and compiling data, which is common in all branches of science (Tekin, 1991). It allows measurements related to psychomotor and affective domain behaviours. It is based on the observation of purposeful behaviours by the teacher or the researcher and recording them visually, audibly and in writing.
- The teacher can benefit from the observation method in order to obtain comprehensive, accurate and fast information about his students during the process and to determine the

degree of student's attainment of the achievements given in the program or the behaviours appropriate to the subject (MEB, 2020).

- It can be used to monitor the student's progress at certain time intervals in performance assignments and studies that require performance.
- It can be used to monitor the behavioural development of individuals in situations where students do not need to use course materials such as paper and pencil.
- It can be used to monitor students' development processes and to provide feedback to students and their families (Gelbal, 2013).
- Observation forms, which were or will be developed in accordance with the subject and purpose, can be applied by using rubrics and checklists in the observation method.

Preparing the observation form

- The first thing to do in order to develop an observation form suitable for the lesson is to determine the purpose of the observation and the behaviors to be observed (Turgut & Baykul, 2013). After these, it should be determined that the behaviors that will show the gain (Nartgün, 2010), where, how, by whom or by whom the observation will be made, how the records will be created and how the evaluation scoring will be done (Turgut & Baykul, 2013).
- Since the individual can show his behaviour partially, the observation form can be prepared in grades (Gelbal, 2013). Since the expressions in the options can be converted into scores, the total score can be calculated and statistical operations can be made from the observation results.

Use of the observation form

- In situations where very complex behaviours or short-term skills need to be observed, the performance process can be videotaped. Afterwards, the details of the behaviors can be observed thoroughly and in detail by watching them in slow motion (MEB, 2020).
- If critical behaviours are observed, it is recommended to use more than one observer (Turgut & Baykul, 2013).
- If observations are to be made in crowded classrooms and groups, the behaviours to be observed should be reduced. The observation period should be extended to cover a few lessons or the number of observers should be increased.
- Possible problems that may be encountered;
- Behavior expressions transferred to the observation form do not fully reflect the outcome,
- The statements in the form are not clear, unambiguous and objective.
- Making sloppy markings on the observation form due to the inability to observe the behavior to be observed sufficiently and carefully.
- Inability of the observer to score equally among the students by losing their objectivity.
- Too high or too low number of unsuitable options in graded observation forms.
- A tendency to shift to good after a behavior that is thought to be good in the individual, and to worsen after a behavior that is thought to be bad (MEB, 2020).

Giving feedback with the observation form

- After the application of the observation form, the evaluation phase is carried out and it is necessary to give feedback to the students here. These feedbacks can be class-wide or individual.
- After the feedback given to the students or the student, the related behaviors should be observed again with the same measurement tool or with alternative measurement tools in order to check whether the detected deficiencies are corrected or not. Thus, concrete information can be obtained about the degree to which students achieve the determined achievements and goals, and the usefulness of the feedback (MEB, 2020).

1.7. PRACTICAL TOOLS IN VARIOUS MODERN TEACHING MODELS

1.7.1 Measurement And Evaluation Techniques And Tools That Can Be Used in Formative Assessment

1.7.1.7 Checklist

- Checklists can be used as a measurement tool or a teaching tool in lessons.
- It is used to monitor what, in what order and how the student will do in accordance with the outcome (MEB, 2020).
- It is mostly used to measure the process.
- It is used to determine whether students follow predetermined rules.
- It is used to determine whether certain transaction paths and steps are followed according to the gains.
- It is used to determine whether a desired or targeted behaviour is displayed (Tekin, 2017).
- It includes the most important and observable aspects of the performance expected from the student in accordance with the outcome.

Checklist Preparation

- The statements in the checklist should be geared towards student behaviour. For this reason, expressions such as listens, does, talks, pays attention, which are third-person conjugations, should be preferred.
- The sub-steps of achievements and performances that are appropriate for the course and the subject should be included as much as possible. Therefore, gains and performances should be listed and included in the table.
- Secret to observable features to facilitate evaluation and control.

Using the Checklist

In the checklists prepared in accordance with the achievements and purpose, after listing the features to be evaluated, an evaluation can be made by opening a separate column for words such as "yes/no" and "yes/no". In addition, the empty boxes in the columns containing the words can be marked with symbols such as "x" or marked. Marking can be done during or at the end of the observation. Checklists can be specific to a student or designed to cover a class or group (MEB, 2020).

Give feedback with a checklist

After the application of the checklists, individual feedback should be given for each feature while evaluating the students. If “no” or “no” statements are marked, which should be considered especially, these indicators should be emphasized and deficiencies and errors should be eliminated (MEB, 2020).

Use of the observation form

- In situations where very complex behaviours or short-term skills need to be observed, the performance process can be videotaped. Afterwards, the details of the behaviors can be observed thoroughly and in detail by watching them in slow motion (MEB, 2020).
- If critical behaviours are observed, it is recommended to use more than one observer (Turgut & Baykul, 2013).
- If observations are to be made in crowded classrooms and groups, the behaviours to be observed should be reduced. The observation period should be extended to cover a few lessons or the number of observers should be increased.
- Possible problems that may be encountered;
- Behavior expressions transferred to the observation form do not fully reflect the outcome,
- The statements in the form are not clear, unambiguous and objective.
- Making sloppy markings on the observation form due to the inability to observe the behavior to be observed sufficiently and carefully.
- Inability of the observer to score equally among the students by losing their objectivity.
- Too high or too low number of unsuitable options in graded observation forms.
- A tendency to shift to good after a behavior that is thought to be good in the individual, and to worsen after a behavior that is thought to be bad (MEB, 2020).

Giving feedback with the observation form

- After the application of the observation form, the evaluation phase is carried out and it is necessary to give feedback to the students here. These feedbacks can be class-wide or individual.
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1.7. PRACTICAL TOOLS IN VARIOUS MODERN TEACHING MODELS

1.7.1 Measurement And Evaluation Techniques And Tools That Can Be Used in Formative Assessment

1.7.1.8 Self, Peer and Group Assessment Tools

a) Self-assessment

- It is an important assessment tool.
- It develops reflective thinking about student work and behaviour.
- It enables students to develop their assessment competencies.
- Individuals question themselves independently, learn, produce and evaluate, review and improve their own products.
- Students have the opportunity to discover their own strengths and weaknesses.
- Individuals make statements by expressing themselves.
- Each student should be allowed to self-assess (MEB, 2020).

Preparing a self- assessment form

- Each student differs individually and in terms of level. In this respect, it is very important that self- assessment forms are suitable for the level of the student.
- The achievements in the curriculum of the course must be taken into account.
- It should be decided at which stage the self-evaluation form will be applied in the course process.
- Expressions that are indicative of achievements should be listed.
- Indicative expressions are transferred to the form.
- The number of items and options in the form should be appropriate for the level of the student, not too many.
- Different self- assessment forms should be used for each subject or course (MEB, 2020).

Use of the self-assessment form

- Continuous self-assessment forms should be used during the evaluation of students. Students can be bored.
- Self-assessment forms are not a self-grading and evaluation tool by students. Because individuals may not be objective while giving scores to themselves, which means that the form deviates from its purpose.
- The main purpose of the self-evaluation form must be clearly explained to the students. They should be asked to express themselves boldly and honestly.
- The criteria can be determined with the participants in the classroom environment and can be done at certain intervals (MEB, 2020).

Giving feedback with a self- assessment form

- Individuals should not only use self-assessment forms but also peer assessment forms. The consistency of these forms with each other should be checked.
- Brief notes and explanations should be given to each student.
- It facilitates the tracking of student progress.
- Individual interviews with students who use negative statements are made to try to eliminate the negativities.
- Self-evaluation results should also be shared with families.
- There should be an exchange of ideas in cooperation with the guidance teachers.
- Self-assessment forms can be reported and filed, thus facilitating individual development follow-up (MEB, 2020).

b) Peer Assessment

- Peer assessment forms are the evaluation of the student's activity or product in individual or group work by his friends or peers according to predetermined criteria in accordance with the achievements.
- Peer assessment forms improve students' self-awareness, ability to criticize, and objective decision-making skills (MEB, 2020).

Preparing a Peer Assessment Form

- It should be prepared according to the development level of the students.
- It should be prepared in accordance with the acquisitions in the curriculum of the course. These gains can be used as benchmarks.
- The active participation of the student in the process should be ensured.
- He should carefully observe and listen to other participants.
- It should be decided in advance at which stage of the course the peer assessment form will be applied.
- At the end of the topic of the course, the expected outcome indicators should be listed. These listed indicators should be transformed into expressions suitable for the peer evaluation form.
- The number of items and options in the peer assessment forms should not be excessive and should be appropriate for the level of the student.
- The peer assessment form should be appropriate for the age and grade level of the students.
- Visuals should be used in younger age groups (MEB, 2020).

Use of Peer Assessment Form

- Peer assessment forms can be used in group assignments or tasks prepared as a result of joint work, in joint presentations, in the evaluation of performance tasks in group activities, and in student studies for practice.
- It can be used to assess students' individual efforts within the group or their contribution to the group.
- Students should be provided with clear and clear information about the peer assessment forms so that the form reaches its goal.
- Students should be informed about the criteria.
- It should be emphasized that they should behave fairly and honestly with the participating students.
- Peer evaluation forms are not an evaluation tool where students grade each other (MEB, 2020).

Giving Feedback with Peer Assessment Form

The suggestions used in the self-assessment form can also be used for peer assessment forms (MEB, 2020).

c) Group Assessment

- Group assessment is the evaluation of work or products produced by a group. This assessment can also be made by the teacher, by other group members in the class, or by other members of the student's own group.
- As a result of this evaluation, it is also essential to gain behaviors such as taking responsibility, acting jointly, respecting different opinions, taking responsibility, making common plans, being a group leader, sharing information and helping each other.

Preparation of Group Assessment Form

- While preparing the group assessment form, first of all, the development levels of the students should be taken into account.
- The achievements in the curriculum of the course can be used as criteria in the form.
- It can be determined to what extent the learners have achieved the achievements and goals.
- The student actively participates in the process.
- Individuals get the opportunity to evaluate their group mates.
- It should be decided in advance at which stage of the lesson the group assessment form will be applied.
- At the end of the topic of the course, the expected outcome indicators should be listed. These listed indicators should be converted into expressions suitable for the group evaluation form.

-The number of items and options in the group assessment forms should not be excessive and should be appropriate for the level of the student.

- The group assessment form should be appropriate for the age and grade level of the students.
- Visuals should be used in younger age groups (MEB, 2020).

Use of Group Assessment Form

The most common problems in group work can be listed as not working equally, not contributing to the process, one person taking full responsibility, lack of communication for the group, taking the assigned tasks directly from the internet, handing over the work to the teacher without being read, having the parents do the work and so on. As a result of these negativities, teachers do not prefer this evaluation. However, the teacher should take the necessary precautions and apply the group evaluation forms.

Giving Feedback to the Group Assessment Form

After the assignment given to the group is handed in, oral attendance can be given to the group members about the assignment. Thus, features such as division of labor within the group, working status, labor sharing and having knowledge about the subject can be scored simply.

1.7. PRACTICAL TOOLS IN VARIOUS MODERN TEACHING MODELS

1.7.2 Examples of Good Practice

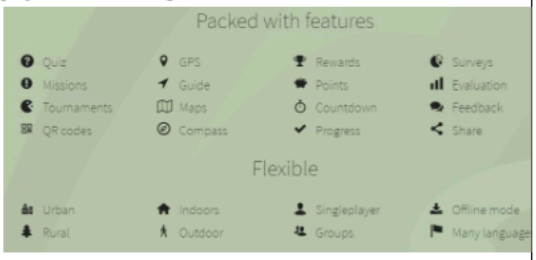
Project Title	Countries	Project Website	Project Outcomes
Items - Improving Tools For E-Assessment In Maths And Science	Czech Republic, Finland, Germany, Slovenia, Spain	https://itemspro.eu/	https://moodle.itemspro.eu/ https://itemspro.eu/cpd-courses/
Assessmake21 Innovative Digital Solutions To Assess 21st Century Skills İn Makerspaces	Ireland, Greece, Cyprus, Sweden	https://www.assessmake21.eu/#about	https://www.assessmake21.eu/io1/ https://www.assessmake21.eu/io2/ https://www.assessmake21.eu/io3/ https://www.assessmake21.eu/io4/
Teacher Assessing Key Competences in School: authentic task based evaluation methodology	Italy, Turkey, Spain, France	http://www.taskeuproject.com/	http://www.taskeuproject.com/products/
DEMAL Design, monitoring and evaluating adult learning classes - Supporting quality in adult learning	Germany, Greece, Romania, Hungary, Spain	http://www.demalproject.eu/index.html	http://www.demalproject.eu/outcomes.html http://www.demalproject.eu/documents/O5_EN_181130.pdf
Key Skills & Employability Assessment Service For Young And Adult Learners	Spain, France, Germany, Greece, Italy, Poland	http://www.keystart2work.eu/en/	http://www.keystart2work.eu/en/outcomes https://training.keystart2work.eu/en/
KeyCoNet	European Commission's Lifelong Learning Program	http://keyconet.eun.org/welcome	http://keyconet.eun.org/teacher-guides http://keyconet.eun.org/project-results

School Education Gateway - Lesson plans using formative assessment	European Commission	https://www.schooleducationgateway.eu/en/pub/index.htm	https://www.schooleducationgateway.eu/en/pub/teacher_academy/teaching_materials/formative-assessment-plans.htm
Guidelines for Developing and Implementing STEAME (Science, Technology, Engineering, Arts, Mathematics and Entrepreneurship) Schools	Cyprus Poland Bulgaria Greece Italy	https://steame.eu/	https://steame.eu/ https://erasmus-plus.ec.europa.eu/projects/search/details/2019-1-CY01-KA201-058240
Family-based Open Science Schooling Project	Turkey Bulgaria Lithuania Greece Poland Spain	https://erasmus-plus.ec.europa.eu/projects/search/details/2019-1-FI01-KA201-060724	https://erasmus-plus.ec.europa.eu/projects/search/details/2019-1-FI01-KA201-060724
Science Olympics Project	European Commission	https://erasmus-plus.ec.europa.eu/projects/search/details/2018-1-PL01-KA229-050699	https://erasmus-plus.ec.europa.eu/projects/search/details/2018-1-PL01-KA229-050699 http://www.sp2.proszowice.pl
Walk through Science Project	France Portugal Ireland Sweden Macedonia	https://erasmus-plus.ec.europa.eu/projects/search/details/2018-1-PL01-KA229-050521	https://erasmus-plus.ec.europa.eu/projects/search/details/2018-1-PL01-KA229-050521 http://www.lo17.wroc.pl
Three Dimensions of Inquiry in Physics Education Project	Belgium Ireland Poland	https://erasmus-plus.ec.europa.eu/projects/search/details/2017-1-SI01-KA201-035523	https://erasmus-plus.ec.europa.eu/projects/search/details/2017-1-SI01-KA201-035523

1.7. PRACTICAL TOOLS IN VARIOUS MODERN TEACHING MODELS

1.7.3 Alternative Measurement and Evaluation Tools In Digital Format and Including Web 2.0 Digital Technologies

1- ACTIONBOUND

Web 2.0 Tool Logo	Actionbound		
Description of Web 2.0 Tool	Actionbound Application is a Web 2.0 tool where we can evaluate and prepare educational games in a fun way.		
Implementation of the Web 2.0 Tool	The work to be done consists of two stages. The first one is to create a free membership on the website with the link below, and after logging in, enter the desired tasks, questions and answers into the system and create an event. The second stage is to apply the prepared activity by using the application downloaded to the mobile phone or tablet with internet connection.		
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	The feature that distinguishes this tool from others is that it has alternative tasks such as voice recording, photo taking, video shooting, location finding, QR Code reading, as well as test applications such as multiple choice. This feature also provides the opportunity to measure and evaluate in accordance with inquiry-based learning, problem-oriented learning, and project-based learning models. 	
	Supported Languages	The website has English and German language support.	
	Pricing	PRO License	300-1250 EURO depending on the number of events that can be prepared
		EDU License	50-450 EURO depending on the institution and the task
		Personal	Free (Limited Usage)
	Compatible Systems	Windows MacOS or Apple OSX Linux Pardus Android IOS	
Web 2.0 Tool Access Links	Website	https://en.actionbound.com	
	Mobile Application	https://en.actionbound.com/download	

2- THAT QUIZ

Web 2.0 Tool Logo	thatquiz	
Description of Web 2.0 Tool	It is a **free service** for **teachers** who want to **replace test papers with online tests** . It is an online gradebook that provides quick analysis of the class and tracking of student progress. It is a hub that allows teachers to share their own resources. It is a skills development site for students, mainly math exercises and tests . It is also a Web 2.0 tool where we can create a virtual classroom, record our students and prepare different types of questions.	
Implementation of the Web 2.0 Tool	After creating a membership to the site and logging in, we create a class from the menu on the left and register our students. Afterwards, we can use ready-made test questions from the "Common Tests" section, as well as prepare tests in the form of multiple choice, matching, slides. Students can reach and solve the prepared tests with "Test Codes".	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	The most important feature of this tool is the interaction by sharing the prepared tests among colleagues. In addition, there are questions in different fields in the ready-made tests section. Mathematics and physics questions can also be written.
	Supported Languages	Turkish, English, German, Spanish, Italian, Portuguese, Catalonian, Slovenian, Polish, Chinese, Hebrew, Ukrainian, Hungarian, Ukrainian.
	Pricing	Free
	Compatible Systems	Windows MacOS or Apple OSX Linux Pardus
Web 2.0 Tool Access Links	Website	https://www.thatquiz.org
	Mobile Application	There is no mobile application.

3- siyOsis

Web 2.0 Tool Logo	siyOsis.	
Description of Web 2.0 Tool	Siyosis Application is a platform where you can register your students by creating a virtual classroom, live lessons with them, instant evaluation opportunity, scoring and money system to buy virtual animals.	
Implementation of the Web 2.0 Tool	After signing up to the site, you can easily create a virtual classroom from the menu on the left, add to the classroom board, and send tests and tasks to students.	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	With online lessons and activities that can be easily added by teachers according to the level of their classes, students can follow their lessons whenever and wherever they want. Teachers can see how much of the lessons students have completed. Teachers can easily prepare tests with the user-friendly test add wizard. They can assign the tests they have prepared to students as a task and follow their results. Siyosis uses Zoom and Google Meet as live course infrastructure. Students can easily track when they have live classes and join classes quickly. Students earn points and money from many activities such as online lessons, assignments, tests, performance in class. While the points allow students to compete, they can buy products added to the market by the teacher or school administration with the money earned. Points are reset in certain periods to ensure the active participation of all students. With Siyosis, you can see students' completed online courses, test achievements, task completion status, last entry times, live lesson attendance statistics, class success status, student status reports.
	Supported Languages	The website has Turkish, English, Arabic, Persian and Russian language support.
	Pricing	It's completely free.
	Compatible Systems	Windows MacOS or Apple OSX Linux Pardus Android IOS
Web 2.0 Tool Access Links	Website	https://siyosis.com
	Mobile Application	There is no mobile application.

4- PADLET

Web 2.0 Tool Logo			
Description of Web 2.0 Tool	Padlet is a wall board. We can add works such as text, pictures, videos, links to the digital board. This tool offers the opportunity to measure and evaluate in accordance with inquiry-based learning, problem-oriented learning, and project-based learning models. It also provides the opportunity to evaluate the process.		
Implementation of the Web 2.0 Tool	It is free to register on the website. It's very easy after that. We can instantly create the digital board by clicking the "Create a Padlet" button on the entered page. We can share it by making the necessary adjustments and layout.		
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	It has become a frequently used tool thanks to its features such as multi-language support, easy use, document diversity, embed code and the possibility to embed it on websites.	
	Supported Languages	It serves 42 languages.	
	Pricing	NEON	Free (Restricted)
		GOLD	150 TL per year. (October 2022)
		PLATINUM	300 TL per year. (October 2022)
	Compatible Systems	Windows MacOS or Apple OSX Linux Pardus	
Web 2.0 Tool Access Links	Website	https://tr.padlet.com	
	Mobile Application	There is no mobile application.	

5- LUMI & H5P

Web 2.0 Tool Logo	 	
Description of Web 2.0 Tool	LUMI is a program installed on the Windows operating system. It is the program of the service provided over the "https://h5p.org" site. You can use the tool online via the website or offline by installing the LUMI program.	
Implementation of the Web 2.0 Tool	The same operations are performed via the LUMI installed on the computer or via the H5P website (by clicking the "Try H5P" button after signing up and entering the site). We choose what kind of assessment and evaluation tool we will use and fill in the content. We can share the link if we want.	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	It provides the opportunity to use many features at the same time: such as lecture presentation, interactive video, multiple choice, quiz, fill-in-the-blank, word drag, arm, drag and drop, image points, true false, branching scenario, interactive book. You can also embed the prepared studies on your website and create content for the EBA platform.
	Supported Languages	The website has Turkish, English and German language support.
	Pricing	Free.
	Compatible Systems	Windows MacOS or Apple OSX Linux Pardus
Web 2.0 Tool Access Links	Website	https://h5p.org https://app.lumi.education
		There is no mobile application.
	Mobile Application	

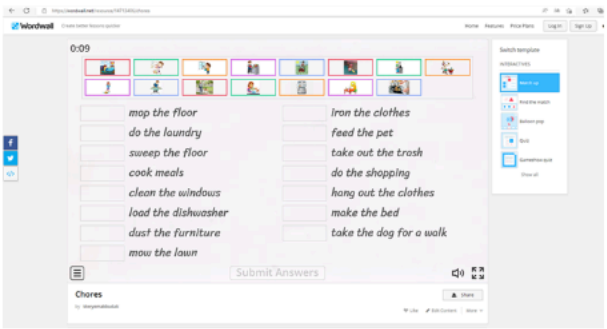
6- SOCRATIVE

Web 2.0 Tool Logo		
Description of Web 2.0 Tool	Immediate feedback is a vital part of the learning process. Socrative gives you this in a classroom setting. It is an effective way to monitor and evaluate learning, saving time for educators and providing fun and engaging interactions for students. Students will be actively engaged in fun activities that involve the whole class in collaborative learning, such as the Space Race quiz.	
Implementation of the Web 2.0 Tool	Socrative is available on iOS, Android, and Chrome apps, and can also be accessed through a web-browser. This makes it easy to use for most students on nearly any device they can get access to, including their own smartphone, for example, which allows for outside-of-class responses, if necessary.	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	Socrative helps teachers discover where students need a little more guidance so that learning gaps can be uncovered and filled.
	Supported Languages	English, Spanish and French
	Pricing	You can use Socrative on smartphones, tablets, laptops and computers. Socrative is 100% free for students on all devices
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://www.socrative.com/
		Mobile app available
	Mobile Application	

7- KAHOOT

Web 2.0 Tool Logo	Kahoot!	
Description of Web 2.0 Tool	Kahoot! is a game-based learning platform used in schools and universities, corporate offices, social settings, and sporting and cultural events. Single or multiplayer trivia quizzes can be done remotely or together. Kahoot is a gamification-based web 2.0 tool where you can make individual or group assessment activities in a fun way, especially at the end of the lesson.	
Implementation of the Web 2.0 Tool	In order to organize an online quiz with Kahoot, you must first create an account. To create an account, we visit kahoot.com and click the Sign Up button.	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	Kahoot activities can be created that energize student groups of all sizes in a short time. It provides a social learning environment. Live events can be designed via video conferencing or face-to-face. Gaps in your learning can be detected instantly with Kahoot. It helps to improve the learning environment.
	Supported Languages	English
	Pricing	Free
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://kahoot.com/
		Students can use Kahoot with both their smartphones and tablets.
	Mobile Application	

8- WORLDWALL & LEARNINGAPPS

Web 2.0 Tool Logo	Wordwall	
Description of Web 2.0 Tool	On this platform, teachers can create interactive and engaging classroom activities either face-to-face or online. After teachers create the content, they can automatically create their activities by choosing an appropriate template. In addition, students can use this platform to do interactive classroom assignments or homework. Teachers can track whether students have completed the activities.	
Implementation of the Web 2.0 Tool	**LearningApps:** The free Web 2.0 platform LearningApps allows teachers and students to create and manage multimedia learning modules online in an engaging format. Writing tool, crossword puzzles, many types of activities can be prepared. 	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	This platform can help save instructors from preparation time, create a more interactive online learning experience, reduce the use of paper worksheets, encourage student-paced learning, and help teachers keep track of their student's progress. **LearningApps:** This allows students to have an active learning experience by engaging with content at their own pace
	Supported Languages	Català, Cebuano, Deutsch, English, Español, Français, Italiano, Türkçe
	Pricing	Basic addition is free
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://wordwall.net/
	Mobile Application	Mobile app available

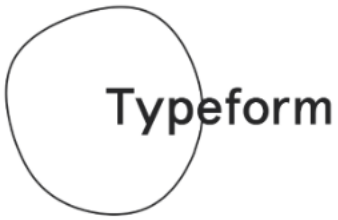
9- TRICIDER

Web 2.0 Tool Logo		
Description of Web 2.0 Tool	It is an online platform that you can use to discuss and vote on any idea. As each participant can express their opinion on this platform, more innovative solutions to problems emerge. You can brainstorm with your students using this platform.	
Implementation of the Web 2.0 Tool	You put a question in the appropriate box and then select who is eligible to comment and vote. Invite people to join in making decisions via Facebook, Twitter, or email. Options include setting a time limit, or closing down the question or discussion.	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	Use this site to develop arguments sides for an upcoming debate or persuasive writing assignment. Promote higher level thinking by asking students to brainstorm options and set criteria to choose. Build mental flexibility as they see alternate points of view on an issue. Encourage your students to use this tool for projects, decision making, and organization.
	Supported Languages	English
	Pricing	Free
	Compatible Systems	Online
Web 2.0 Tool Access Links	Website	https://www.tricider.com/
	Mobile Application	There is no mobile application.

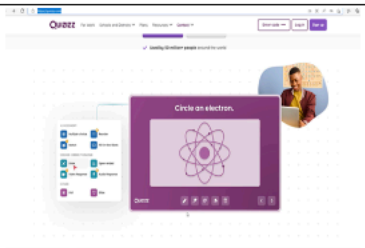
10- MENTIMETER

Web 2.0 Tool Logo		
Description of Web 2.0 Tool	By using this tool, classroom work can be made more interactive and fun for both students and teachers. It can be used to create formative assessments and discussion and to test knowledge with fun quiz competitions. It increases class participation. It is suitable for all kinds of education, from primary to higher education (https://www.mentimeter.com/solutions).	
Implementation of the Web 2.0 Tool	Choose to sign up through your Facebook profile, Google account, or with an email address and password that you set. If the latter, enter a valid email address, a password that is at least six characters long, and your first and last name. Press	
	'sign up' and you are good to go! On your Dashboard, click the button "+New presentation". Give it a name and click "create presentation". You will be taken directly to the Edit view, where you can start to add slides.	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	Interactive presentations can be created with easy-to-use online communication. Questions, polls, quizzes, slides, images can be added to your presentation to create fun and engaging presentations
	Supported Languages	English
	Pricing	Limited use free
	Compatible Systems	All that is needed for you to start using Mentimeter is an internet-connected device
Web 2.0 Tool Access Links	Website	https://www.mentimeter.com/
	Mobile Application	All that is needed for you to start using Mentimeter is an internet-connected device

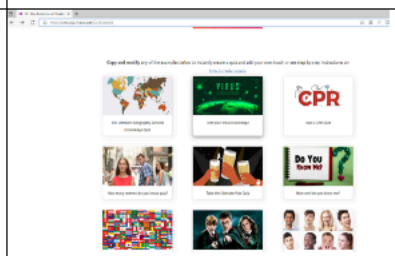
11- TYPEFORM

Web 2.0 Tool Logo		
Description of Web 2.0 Tool	Typeform allows you to easily manage enrollments, engage students with fun quizzes, and collect necessary feedback. It can be used to make learning fun.	
Implementation of the Web 2.0 Tool	Pick a template or start fresh. Build a simple form in minutes. - No coding needed. Explore templates. Create your own. Typeform from scratch. Share. - Embed into your website. - Launch in an email. - Or just share the link. Get results.	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	Typeform lets you easily manage registrations, engage students with fun quizzes, and gather essential feedback. Make learning fun, and leave a lasting impression while you're at it. Get started now with these beautiful free templates.
	Supported Languages	English, Spanish
	Pricing	Paid
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://www.typeform.com/
	Mobile Application	Available on Android and iOS

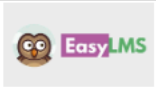
12- QUIZIZZ

Web 2.0 Tool Logo	QUIZIZZ	
Description of Web 2.0 Tool	Quizizz is a website that allows them to do formative assessments. You can send the activities you create on this platform to students as homework. Course scores and self-confidence can be increased by enabling students to practice. In this way, the teaching environment can be improved based on data. Many types of questions can be prepared with this tool. Some features such as reading aloud provide convenience to students. Unlimited access to many customizable events.	
Implementation of the Web 2.0 Tool		
		
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	Quizizz has evolved from a simple quiz game into a teacher and student-friendly learning platform that integrates sophisticated quizzes into a slide-based learning experience. Teachers can opt to run quick quiz reviews or integrate quizzes into interactive lessons with instructional supports. They can also run these lessons live or assign out self-paced options. All of these features, plus the custom question-by-question feedback, give Quizizz a unique niche in the crowded world of quiz and game show tools. It's a tool that can do it all and well, thanks to how customizable everything is. Teachers can add audio directions, embed videos, add polls, or asking students to draw on or label slides. Lighthearted themes, images, leaderboards, question timers, and music can boost the experience for students.
	Supported Languages	English, Français ,Espanol, Deutsch, İtaliano, Türkçe, Potugues, ect..
	Pricing	Limited use free
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://quizizz.com/
	Mobile Application	Available on Android and iOS

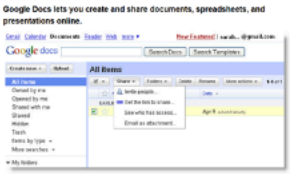
13- QUIZ MAKER

Web 2.0 Tool Logo	quizmaker	
Description of Web 2.0 Tool	Quiz Maker is a free platform for creating quizzes. It allows easy exam preparation due to its simple interface.	
Implementation of the Web 2.0 Tool	 Source: https://www.quiz-maker.com/QuizExamples	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	Different activities and exams such as trivia, personality, grades, surveys, and polls can be prepared.
	Supported Languages	English
	Pricing	Limited use free
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://www.quiz-maker.com/
	Mobile Application	Available on Android and iOS

14- ONLINE QUIZ CREATOR

Web 2.0 Tool Logo		
Description of Web 2.0 Tool	This tool is an online exam system. The easy online quiz builder can create quizzes for any difficulty level.	
Implementation of the Web 2.0 Tool		
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	Teachers can easily create their online quizzes and give feedback to participants. It is easy and simple to use. This tool can be used on phones, tablets and computers.
	Supported Languages	English ,Español, Français, Italiano etc.
	Pricing	It's free for 7 days
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://www.onlinequizcreator.com/
	Mobile Application	Computers Tablets Smartphones

15- GOOGLE DOCUMENTS

Web 2.0 Tool Logo		
Description of Web 2.0 Tool	Online documents can be created from any device and collaborative work can be done on these documents. Helpful features like Smart Typing help you type faster with fewer mistakes.	
Implementation of the Web 2.0 Tool	 Source: http://elearning.daremightythings.com/NG-Fam/web20/default.aspx?chp=1	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	You can focus on the ideas, not the writing. It also saves time with spell checking, grammar suggestions, voice typing and fast document translation. Docs can easily connect to other Google apps, saving time. Prepared documents can be easily shared via Google Meet (https://www.google.com.tr/intl/tr/docs/about/#features).
	Supported Languages	English ,Español, Français, Italiano etc
	Pricing	Free
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://www.google.com.tr/intl/tr/docs/about/#overview
	Mobile Application	Available on Android and iOS

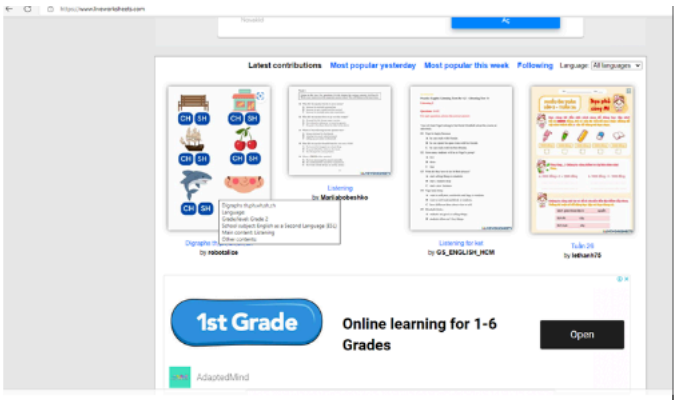
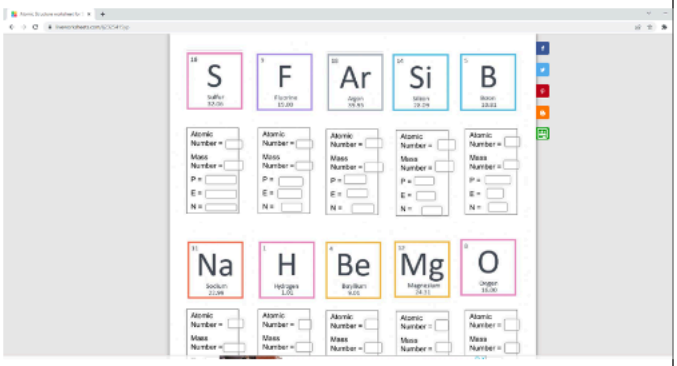
16- GOOGLE CLASSROOM

Web 2.0 Tool Logo		
Description of Web 2.0 Tool	This tool can be used to give and receive homework, increase collaboration, and improve communication. It can be used on mobile phones, tablets and computers. (https://support.google.com/edu/classroom/answer/6020279?hl=tr).	
Implementation of the Web 2.0 Tool	They can be used to teach curriculum content, store data, create/edit video, edit photos, collaborate and so much more. These programs are often free and are used by teachers, students, and sometimes parents, both in and out of the classroom, on a pretty regular basis. https://kidsdiscover.com/teacherresources/web-2-0-tools-classroom/	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	Teachers can start a video meeting, and create classes, assignments, and notes. Assignments can include materials such as YouTube videos, a Google Forms survey, and other items in Google Drive. Announcements can be posted. and discussions can be made on any topic. Lots of sharing and feedback can be given. Students can monitor their classwork and submit assignments. They can interact with the teacher and with their classmates
	Supported Languages	English ,Español, Français, Italiano etc
	Pricing	Google Classroom is available for free for schools that are using Google Apps for Education., but there's a paid G Suite Enterprise for Education tier that includes additional features, such as advanced videoconferencing features, advanced security and premium support.
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://classroom.google.com/
	Mobile Application	Available on Android and iOS

17-WOOCLAP

Web 2.0 Tool Logo	wooclap	
Description of Web 2.0 Tool	It is a tool that helps you understand your students' thoughts and knowledge on a particular subject in a very short time.	
Implementation of the Web 2.0 Tool		
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	Exams consisting of different types of questions such as Multiple choice, Poll, and Find a Number can be prepared. With Brainstorming, a structured discussion can be initiated and students' ideas can be obtained and categorized on a particular topic. (https://www.wooclap.com/en/questions/)
	Supported Languages	English, Español, Français
	Pricing	Wooclap is free for K-12 teachers to use, and we offer special rates for higher education
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://www.wooclap.com/
	Mobile Application	There is no mobile application.

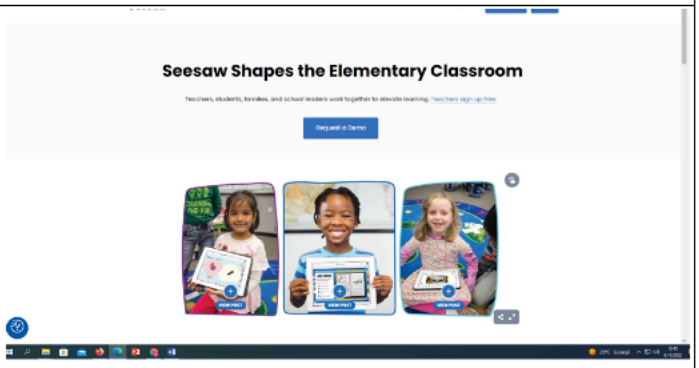
18- LIVE WORKSHEETS

Web 2.0 Tool Logo	LIVEWORKSHEETS	
Description of Web 2.0 Tool	Interactive worksheets can include sounds, videos, drag and drop exercises, merging with arrows, multiple choice etc.. and even speaking exercises that students have to do using the microphone (https://www.liveworksheets.com/aboutthis_en.asp).	
Implementation of the Web 2.0 Tool	 Sample live Worksheet (https://www.liveworksheets.com/lj2325415yp) 	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	With this tool, traditional printable worksheets (doc, pdf, jpg...) can be turned into self-correcting and interactive online exercises called "interactive worksheets". Students can make worksheets online and send their answers to the teacher. This is motivating for the students and a time saver for the teacher. It also contributes to the protection of the environment by saving paper.
	Supported Languages	English, Español
	Pricing	Free
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool	Website	https://www.liveworksheets.com/

18- LIVE WORKSHEETS

	Pricing	Free
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://www.liveworksheets.com/
	Mobile Application	There is no mobile application.

19- SEESAW

Description of Web 2.0 Tool	It is a tool that can be used to collect student work and share it with their families. Students "show what they know" using photos, videos, drawings, text, PDFs, and links. It is an online tool where students can showcase their work and achievements.	
Implementation of the Web 2.0 Tool		
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	Seesaw works on every device type! The Seesaw app is available on iOS, Android, and Kindle Fire devices. It encourages students' creativity. It allows students to see their work by more people. It contributes to communication skills.
	Supported Languages	English
	Pricing	Seesaw is free for families.
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://web.seesaw.me/
	Mobile Application	Available on Android and iOS

20-MINDMEISTER

Web 2.0 Tool Logo		
Description of Web 2.0 Tool	MindMeister is an easy-to-use, web-based environment where you can do activities such as mind map, brainstorming, note taking, project planning without downloading.	
Implementation of the Web 2.0 Tool	Visit www.mindmeister.com to access the MindMeister dashboard. Click the **plus icon (+)** at the top of the dashboard to create a new mind map. Double-click the central (root) topic in your mind map to **name your map.** Press **ENTER** to create sibling topics. Press **TAB** to create subtopics.	
Evaluation of the Web 2.0 Tool	Positive / Negative Sides	With mind maps, it can store and structure large amounts of information. They show the hierarchy and the relationships between ideas. With this tool, you can create your mind map while doing presentations, group work, and project planning.
	Supported Languages	English, Deutsch, Italiano, Spanish, Espanol, etc.
	Pricing	Limited use free
	Compatible Systems	Windows MacOS or Apple OSX Linux
Web 2.0 Tool Access Links	Website	https://www.mindmeister.com/
	Mobile Application	Available on Android and iOS

5. A SAMPLE MEASUREMENT AND EVALUATION IMPLEMENTATION GUIDE AND SCHEMES

5.1. Actionbound App (Web 2.0 Tool Application Example)

In the App, the name of each study is called “Bound”. The following steps are done to create a bound.

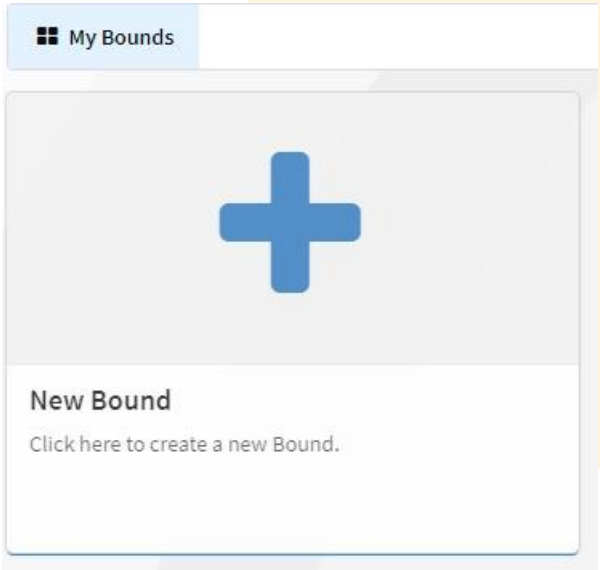
1. By clicking https://en.actionbound.com website, free membership is made from the “SignUp” section in the upper left section (Picture-1).

Picture 1

In the App, the name of each study is called “Bound”. The following steps are done to create a bound.

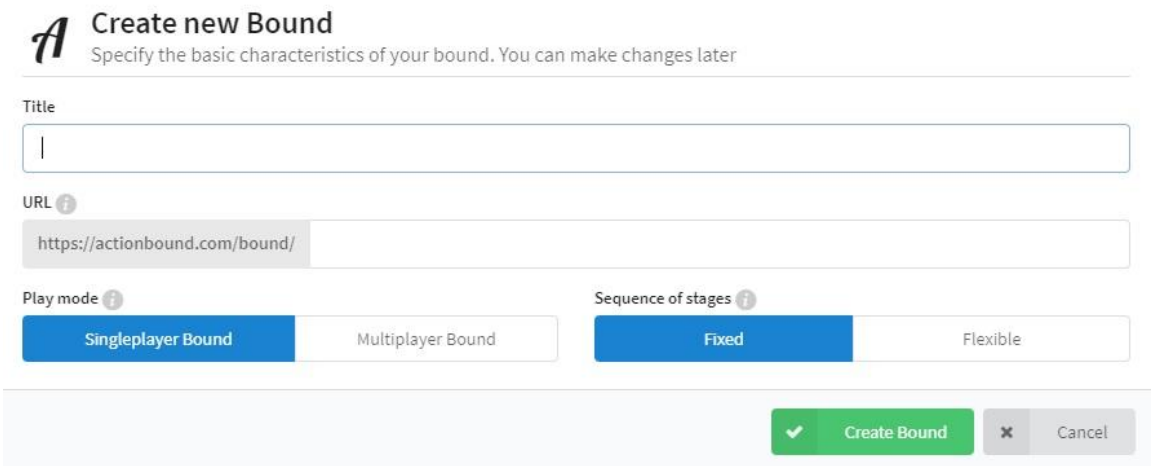
1. By clicking https://en.actionbound.com website, free membership is made from the “SignUp” section in the upper left section (Picture-1).

2. After logging in, the “New Bound” button is clicked on the screen that appears (Picture-2).



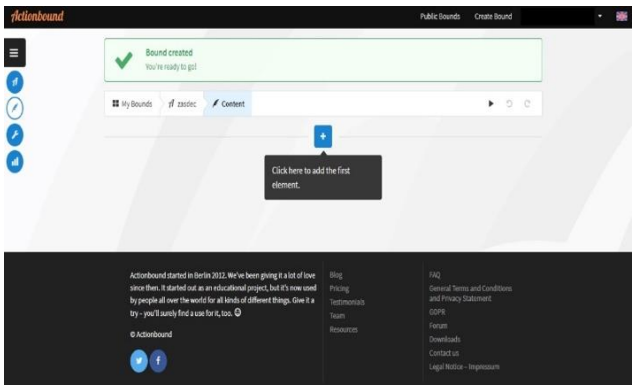
Picture 2

3. In the window appears, we write a name and URL extension for the event we will prepare (Picture-3).

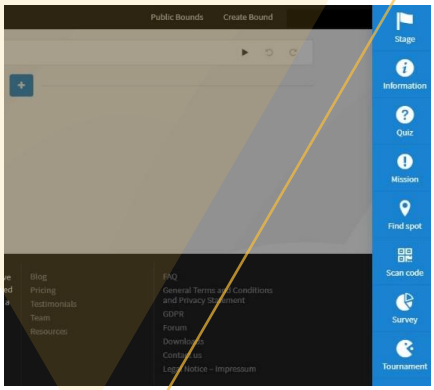


Picture 3

4. Questions or tasks are added by clicking the "+" symbol of the screen (Picture-4). By clicking on the tabs in the menu to be opened on the right side of the screen, we determine the task we want to add (Picture-5). From the right menu , tasks such as promotion, quiz, photo-video-sound recording tasks, location determination, QR Code reading, survey can be added.

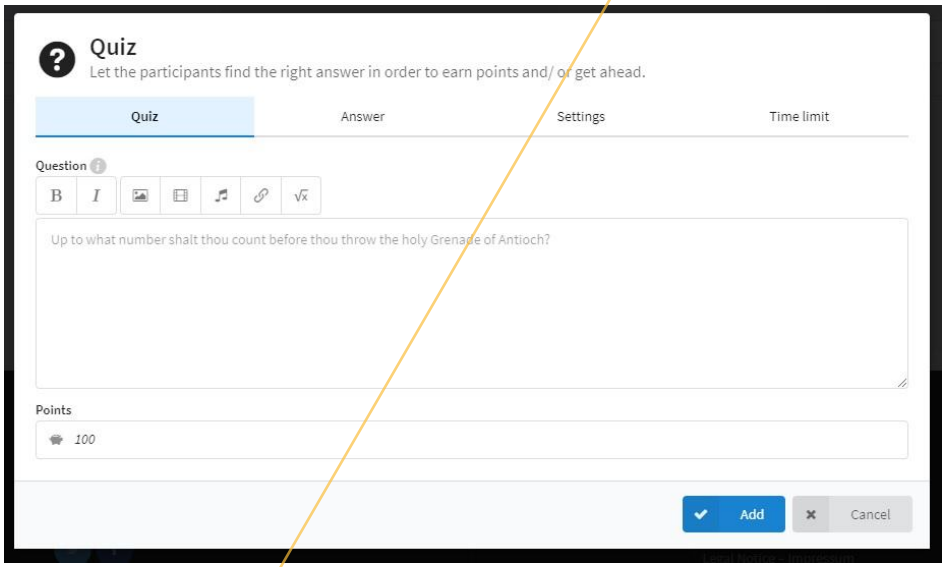


Picture 4



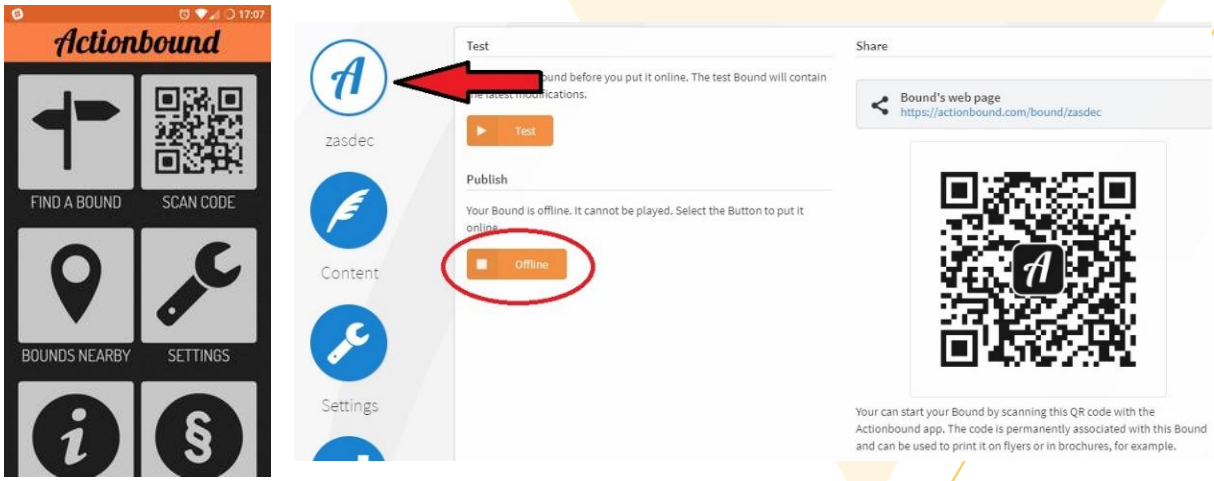
Picture 5

5. When the task tabs in the right menu are clicked, the relevant fields are filled in the window that appears and the addition is completed (Picture-6).



Picture 6

6. After the tasks are completed, they are made "Online" from the page that is opened by clicking on the Actionbound logo. All changes to be made after this must be updated in this field. The QR Code on this page is required to start the test (Picture-7).

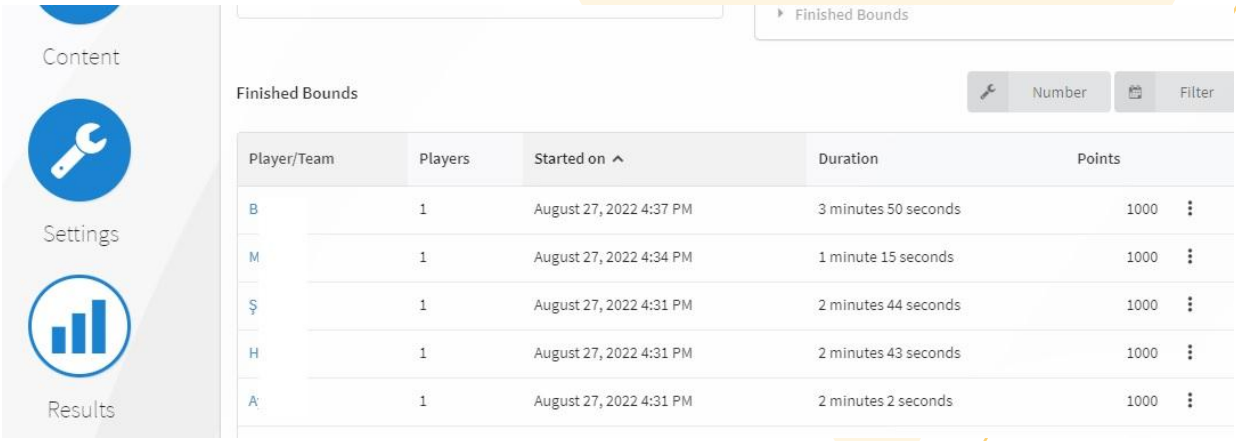


Picture 7

7. After the tasks completed from the Website, the implementation phase will begin. Therefore, it is necessary to enter the application to be installed on devices such as phones and tablets with internet connection. When the application is opened, the initial QR Code is read or the bound name is searched by clicking on the “Scan Code” button. Afterwards, the tasks we have prepared will appear on the screen in order and the users are asked to perform these tasks (Picture-8).

Picture 8

8. After the study is completed, the evaluation section on the website is checked (Picture-9).



Picture 9

5. A SAMPLE MEASUREMENT AND EVALUATION IMPLEMENTATION GUIDE AND SCHEMES

5.2. Portfolio Review Example With Rubrics

For the teacher;

0 - no evidence,

1 – limited,

2 – average,

3 – good,

4 – perfect

Learning Outcomes **Identify the types of learning outcomes associated with key skills and science topics in the course content (cognitive, social, affective, etc.)**	**0 / No Evidence**	**one**	**2**	**3**	**4**	**Notes**
Can make / Can apply / Analyzes… etc;						

For the student's self-evaluation;

0 - no evidence,

1 – limited,

2 – average,

3 – good,

4 – perfect

Learning Outcomes **Identify the types of learning outcomes associated with key skills and science topics in the course content (cognitive, social, affective, etc.)**	**0 / No Evidence**	**one**	**2**	**3**	**4**	**Notes**
Can make / Can apply / Analyzes… etc;						

Rubrics

Features	(1) Insufficient or missing	(2) Partly enough	(3) Sufficient	(4) Perfect
Suitability for Purpose	The event is not prepared for the purpose	The event has been prepared partially for the purpose.	The event has been prepared in accordance with most of the purpose.	The event has been prepared in accordance with the purpose.
Reporting	The report has not been prepared in accordance with the purpose.	The report has been prepared partially for the purpose.	The report has been prepared in accordance with most of the purpose.	The report has been prepared in accordance with the purpose.
Originality	There is no originality in the design of the event.	The event design has been partially original.	The event design was original.	In the design of the event, it was original in a different way from its peers..
Completion of the Process	The time determined in the event design was not complied with..	The time determined in the event design was partially complied with.	The time determined in the event design was complied with.	The event design was made before the determined time.

Observation Form-1

Features	**(1) Insufficient**	**(2) Partly enough**	**(3) Sufficient**	**(4) Perfect**
Indicates that not all plants used in the event have the same characteristics.				
He/She can group the plants used in the activity according to their characteristics.				
He/She can group the plants used in the activity as with or without seeds.				
Specifies the necessary conditions for the plants used in the activity to survive.				
Specifies the necessary conditions for seed germination in seed plants.				

Observation Form – 2

Features	**(1) Insufficient**	**(2) Partly enough**	**(3) Sufficient**	**(4) Perfect**
During the event, she/he gave original answers to the questions.				
During the activity, she/he made logical comments to the questions.				
During the activity, she/he gave answers to the questions earlier than her peers.				

Observation Form – 3

Features	Appropriate	Not available
During the event, she/he gave original / innovative answers to the questions and developed a solution to the problem.		
During the event, she/he made logical comments to the questions.		
She/He acted as an entrepreneur during the event.		
She/He took the initiative in making decisions in events.		
She/He was eager to communicate and work collaboratively.		
She/He was sensitive and respectful to those around her/him.		
She/He used her/him robotic parts correctly and made the appropriate algorithm.		
She/He connected the sensors correctly and used them for the purpose.		

Self-Assessment Form – 1

Student Name Surname: Class: Its number: Event Name: Event Date: Materials Used in the Event:
1. What did I learn in this activity?
2. What were the parts of this activity that I enjoyed the most?
3. What were the most difficult parts of this activity?
4. What would I change if I did this activity again?
5. Where and how can I use what I learned in this activity in my daily life?
My inferences

Self Evaluation Form – 2

Student information				
Evaluation Criteria	**(1) Insufficient or missing**	**(2) Partly enough**	**(3) Sufficient**	**(4) Perfect**
I prepared it for the purpose of the event.				
I prepared the report in accordance with the purpose.				
I became unique in the design of the event, different from my peers.				
I made the event design from the specified time.				
I actively participated in the events.				
I took responsibility for the events.				

Individual and Group Evaluation Form

Student information	1st Student				2nd Student				3rd Student			
Evaluation Criteria	**(1) Insufficient or missing**	**(2) partly enough**	**(3) Sufficient**	**(4) Perfect**	**(1) Insufficient or missing**	**(2) partly enough**	**(3) Sufficient**	**(4) Perfect**	**(1) Insufficient or missing**	**(2) partly enough**	**(3) Sufficient**	**(4) Perfect**
The event has been prepared in accordance with the purpose.												
The report has been prepared in accordance with the purpose.												
In the design of the activity, different from its peers, it has been unique.												
The event design was made from the specified time.												
Actively participated in events.												
Responsible for events.												

Project Design Study - Example of Drawing Study

Materials to be Used in Project Design
Construction Stages of the Project
Project Design Drawing
Implications and Comments

Other Rapid Techniques That Can Be Used for Formative Assessment

Card display technique

Quizzes

Kahoot

Creating a slogan

Social media dashboard

Flashcards

Yes/No cards

Question box

Emojis

Analogy

Double column

Punch to five

Thumbs up/thumbs down

Cornering

Teach friend

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