Towards Inclusivity in Education – Project Based Learning (PBL) and Collaborative Methodology to Enhance 21st-Century Skills

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Abstract

Enhancing 21st-century skills is of key importance in finding the relevant methods that bring on social change. With the Project Based Learning (PBL) program described here we offer a framework for this need and provide useful practices for future pedagogical programs. Our study integrates findings from the psychology of learning; thus, it highlights the importance of type of learners' skills in education. PBL builds on collaboration, which makes it particularly useful in educating students with atypical development. We describe applied aspects of projects from different levels and forms of education [elementary, secondary, English as a Second Language (ESL) and green pedagogy] which can serve as a compass for new directions in foreign language teaching, implementable in teacher training programs even for special education programs. Thus, this method enhances smooth intercultural communication with the potential of bringing on social change[1].

Keywords

21st-century skills; ESL; green education; project method; psychology

[1] The present article is a result of a fruitful collaboration of several professionals from different levels of education. I hereby would like to thank all colleagues and all the reviewers for their valuable comments, which largely helped us to articulate how the described PBL paradigm can be of use for future generations and even children with atypical cognitive and language development. Issues on further educational corollaries of interpretations other than the westernized thought, and a different perspective on individualistic, psychological aspects is still a topic for future research and can serve as a valuable source for further analysis.

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1. Introduction

Today's educational sciences face the challenge of applying feasible and efficient methodology relevant for 21st-century generations. A crucial question of pedagogy and educational sciences is the application and fostering of **21st-century skills** in everyday institutional teaching practice. Such competencies are not like traditional, lexical-knowledge based forms of intelligence, but are rather, domain-general competencies, which can ensure an applied aspect of acquired knowledge at school. In other words, these provide a means for the real effective use and practical skills-based **application** of theoretical content, forms of creative innovative and efficient implementation, which definitely represent values. Such 21st-century competencies in education are also known as the **four C's:** Creativity, Critical thinking, Collaboration, and Communication. The gradual emergence of these competencies also brings on the spread of applied techniques and the ability of putting knowledge into practice in and outside classrooms (Aben 2022, Graham, Matthews, Eslami 2020). Although there may be other frameworks for educational theories, in the present paper we focus on the 4C's of education as a source and background theory for guidelines to future benefits of methodologies with the power of bringing on social change, because in our view this framework is most adapted to the implementation of educational practices with the aim of channeling them into behavioral changes at the level of our society.

Figure 1 – 21st-century skills and competencies in Education (4C's).

In this approach the project method is one efficient pedagogical strategy, where students' activity and their role in the unfolding of the process of learning is central, and where this approach capitalizes on students' natural inclination and thus motivation (Halvorsen 2018, Plucker, Kaufman, Beghetto 2016). The energy deriving from such interests ensure long-term motivation in achieving pragmatic, applied goals. Importantly, teachers gain a new role: they are more like a **mediator, a facilitator**, supporting the process of acquisition and learning, rather than providing basic lexical knowledge and chunks of information units to students.

A crucial aspect of the Project Method is also that these creative energies that serve as the engine of the learning process are also maintained as the final goal of the given project is set by both the students and the teachers, and the steps of achieving these objectives is also ensured at both **the individual and the collective level**, in that the teacher is there to guide this progress of learning and development, not overlooking the pedagogical goal, the final objective that must be served. But the students, each individually can and should contribute with their own ideas to the common framework, which ensures that the learning procedure takes place simultaneously at both levels: at the collective (common final objective being ensured and fulfilled), and at the individual level (each student can contribute with his/her natural interest-based ideas). This way students' strength and **motivation** will ensure that this learning process and educational method is **sustainable** in the long run, and enables every participant to take part actively, with his/her own preferences. This symbiotic collaboration is something that gives satisfaction both to the teacher and the students, and therefore ensures a successful framework of education and a methodology that can strengthen 21st-century skills, in a way where the engine of the learning process are the students themselves, and the teacher takes on a role somewhat different from traditional teaching methods (especially in non-individualistic cultures following the Prussian tradition in education), the role of a **moderator**, rather coordinating events from the background, ensuring that the final educational objective, the pedagogical goal is achieved.

This efficient framework and methodology can be a valuable alternative for future educators, where they can find strategies and techniques that ensure applied knowledge, which eventually guarantees that their

methodology gets enriched with novel, creative and energetic solutions in pedagogical practice.

1.1 Theoretical premises – Contributions of our study to the nurturing of 21st-century skills and inclusivity in education

Didactic benefits of such methodology include interdisciplinarity, collaboration, the integration of different cultures and thus the improvement of intercultural communication across cultures and in the classroom. Such virtues teach students to be democratic and enhance inclusivity in communities (Cottini, Morganti 2016, Mitchell 2015), which make it especially efficient for ESL (English as a Second Language) teaching, language learning and for the internalization of cultural knowledge.

We not only offer an applied method of sustainability in education with a focus on green education with the VIZED (Y'our Water) Project of Leőwey High School in Pécs, the partner institute of the University of Pécs and our Institute for Cultural and Social Sciences, but with an overview of the basic notions of Project Pedagogy as a method in rebirth in modern educational approaches, the major principles and their connections to reform pedagogical perspectives are defined, and highlighted, showing how the Project Method is particularly suited for foreign language practices in general and for the teaching of foreign languages, including ESL teaching as well, in understanding other cultures. In this second part where we describe a language teaching methodology, we delineate a representative example of the Project Method in the ESL classroom: the ZOOm-in-Project of the English program's project in Deák Elementary School of the University of Pécs, a partner institute of our Faculty. The ZOOm-in-Project is a concrete example of the project method's creative fruitful application in the foreign language classroom. The next steps are also provided, where we reveal the exact parts and phases of the project with important notes on potential pitfalls and future corollaries in the realization phases for teachers and educators.

Importantly, the study is based on a sample where the participants are all native speakers of Hungarian. In the sustainability project the participants are high-school age students, whereas in the ESL project they are elementary school children specializing in language learning in an ESL program. In this latter case the project method targets English vocabulary

development outside the classroom framework. *In our study such pedagogical practices are portrayed as techniques to enhance 21st-century skills* in education with a focus on sustainability in teaching practices, green education, and museum-pedagogy, where the study material is taken out and back in the classroom, but with the purpose of being brought back to the classroom.

1.2 Roots of Project Based Learning (PBL)

The first instances of the emergence of the project based collaborative methodology go back to the 1900's when university lecturers used the term for the first time. Then in 1918 professor W. H. Kilpatrick of Colombia University made formal attempts to use it in education, based on John Dewey's philosophy of pragmatism, which stresses the principle of «learning by doing» (Dewey 1938, Hegedűs, Szécsi 2002, Szécsi 2021). The collaborative idea is also deeply embedded in interactionist views of developmental psychology, namely the works of Vigotskij (1997) and also build on Gokhale's works (1995) who points out the interaction of collaborative work and critical thinking[2].

Major principles of the method are that

— It takes the student beyond the walls of the classroom. This ensures an applied aspect of the learned material that does not stay at the theoretical level but gets implemented and channeled into real practice, which also ensures the potential of bringing on social change for a better future (Szécsi 2013a, 2013b, Schnell, Zalay, Gombás 2021).
— It is carried out in a natural setting; thus, it makes learning realistic and experiential.
— It encourages investigative learning and solution of practical problems.

[2] There is vast pedagogical literature on Dewey's work and methodological proposals, as well as on pedagogical corollaries going far beyond the boundaries of a 'Western' horizon (see, e.g., Freire 1972, 1974, Thomas 1999, Nussbaum 2009), which develop the principles listed in this paragraph, and other aspects characterising the methodology presented in the article – however the discussion of these are beyond the scope of this paper, and for limitations of space we do not investigate them in detail. (For more on these ideas see Thomas 1999, Nussbaum 2009).

— It is focused on the student as it enlists his/her active involvement in the task set.
— It encourages the spirit of scientific enquiry as it involves validation of hypotheses based on evidence gathered from the field through investigation.
— It promotes a better knowledge of the practical/functional aspects of knowledge gained from books.
— It enhances the student's social skills, as it requires interaction with the social environment.
— The teacher plays a facilitative role rather than the role of an expert.
— It allows the students a great degree of freedom to choose from among the options given to them, hence it provides a psychological boost.
— It encourages the spirit of research in the student.

1.3 Description of the PBL methodology – Evidence for its efficacy

There are several methods in education and plenty of criticism evaluating benefits vs. costs of applying them. However not many targeted the integration of the psychology of learning into the development of the methodology. PBL happens to be a method where the fundamentals lie in important tenets of the psychology of learning, making its efficiency apparent, enhancing its benefits in all ages (Janacsek, Fiser, Németh 2012). It applies findings from the cognitive psychology of learning (Quentin *et al.* 2021). Such psychology-based approaches in teaching ensure that the specificity of age-groups are also taken into consideration when drawing up a methodology and in the specific steps of implementation as well (Fanuel *et al.* 2022, Janacsek, Németh 2022).

As the efficacy of PBL has, to our knowledge, not been the subject of meta-analysis and systematic review, our study would like to make up for this hiatus and give a theoretical summary why the method is an efficient strategy for all learners, even students with learning difficulty (dyslexia, AHDH, milder Autism Spectrum Disorder cases). We highlight the flexibility of the method in applying it to diverse populations and age groups, which further enhances its utility and applicability. In order to demonstrate the efficacy, below in 3.2. we describe the principles of PBL that demonstrate evidence for its effectiveness as well.

1.4 Definition of a Project in PBL methodology

A project is a whole-hearted purposeful activity proceeding in a social environment – as defined by W. H. Kilpatrick (1918). It is a bit of real life that has been imparted into school (Ballard 1995), a voluntary undertaking which involves constructive effort or thought and eventuates into objective results (Trevor, Bathurst-Hunt 2018). Such an enterprise is always a significant practical unit of activity of a problematic nature planned and carried to completion by the pupils in a natural manner involving the use of physical materials to complete the unit of experience (Thomas 2000).

A project is any unit of activity, individual or group, involving the investigation and solution of problems, planned, and carried out to conclusion under the guidance of the teacher (Bús 2013, Szécsi 2021). It is a systematic teaching method that engages learners in acquiring knowledge and skills through an extended inquiry process structured around complex, relevant questions, carefully designed products, and authentic tasks (Schnell, Zalay, Gombás 2021, Schnell, Fóti, Kochné 2021).

1.4.1 Symbiosis of collective and individual levels

The collaborative stance ensures that the children, or students can all choose their own strengths in connecting to the topic at hand: the given channel that provides the context of connection is their interest. This further guarantees that students are motivated throughout the learning process as they enjoy their individual activity with which they fruitfully contribute to the common objective and educational goal at hand.

The differentiation that the PBL method allows is beneficial for cognitive, educational reasons and for factors of social-economic integration as well. Learners have different skills, interests, strengths and weaknesses, and an educational method that can capture this scheme and offer a framework where students can get engaged through their own channel is truly revolutionary. Types of learners can be identified on the basis of cognitive and pedagogical tests in the field, which will reveal which type of learner the student is: Auditive, Visual, Cognitive, Imitative or Kinesthetic.

2. The psychology of learning in educational methods – Types of learners

Children display different learning styles and preferences already as preschoolers and as very young learners. There are five basic learning styles that are utilized (Marshall 2019, Szita, Pelcz 2019) – each as unique as the people who use them to learn and communicate with others. Understanding and implementing these types of learning styles can be beneficial to early childhood development and foster educational and creative processes. Students' strengths can provide productivity and achievement in the classroom. We believe in individual differences, in multiple intelligence (Gardner 1983) as scientific evidence supports that we all have cognitive strengths and weaknesses. Luckily educational approaches can align to these in implementing these types of knowledge (Morin 2001), just as PBL allows their integration. Scientific evidence from the cognitive psychology of learning largely supports the existence and validity of the differentiation of Types of learners in the evaluation of educational methodologies, and our study is written in this framework, with approach believing in individual cognitive differences. Those who oppose this theory might suggest the use of multiple means of curricula which is basically a paraphrase of multimodality advocated by the type of learner theory-based methodology. We, therefore, rely on this as our basic tenet in evauating the benefits of PBL in the forthcoming parts of our study, and describe the major types of learners below.

2.1 Imitative learners

Imitative, or linguistic, learners prefer using words and language, both in speech and writing. They focus on the sound and meaning of words when seeking understanding, and benefit from rhymes and repetition, although they are focused more on the meaning of the words than the sounds they make. Imitative learners use words, phrases, and dialogue to create a mental image or imagine a scenario, much like visual learners. The learners tend to be quick with picking up new words or languages. They are able to understand different linguistic styles and remember linguistic information well. They are attracted to reading and writing and will view writing assignments like essays and short stories to be a positive challenge.

Characteristic of imitative learners:

- They are good at reading and writing
- Are self-reflective, understand philosophy and abstract reasoning
- Enjoy learning new words and new languages
- Outspoken and opinionated

2.2 Visual learners

Visual, or spatial, learning is when a person learns more effectively through seeing and watching. This type of learner uses pictures, images, videos, and spatial understanding to memorize and organize information, and grasp concepts. For visual learners, the mind's eye is everything. If they «can't quite picture it», then they are less likely to understand and remember it. The intentional use of simple, but eye-catching images are very useful and recommended. Visual learners can struggle with notetaking, as words don't always do the trick. To aid in this, visual learners may use highlighters or mark with color to sort data, use pictures in place of words, and are proficient in their sense of direction.

Visual learners have an easier time learning through videos and visual scenarios and retain more information through reading than listening. It is all about what they can see. Maps, charts, graphs, lists, and flashcards are all useful tools for visual learners. Outlining essays and other writings may aid in the thought process, as visual learners can work through thoughts in an organized manner.

This trait also makes the learners especially susceptible and open to information-technology based online learning materials, which naturally connect to the project method in that an applied technique with multimodal facilities highly increases the efficiency of the learning process in all fields.

Features of visual learners:

- They are able to convey complex ideas visually
- Comprehends charts and graphs quickly
- They are very structural and thus well-organized
- Prefers to read than listen
- Good at recognizing patterns

2.3 Auditive learners

Auditive learners prefer to learn through sound and music. This type of learner may do better with memorization songs, and repetition, as well as rhymes and rhythms. They are listeners and are often an active part of lessons, asking and answering questions. Discussion is their best friend when attempting to understand an idea, verbally walking through a problem or explanation. They may paraphrase to simplify and use repetition to memorize difficult concepts.

Auditive learners typically:

- Follow verbal directions well
- Actively participate and speak up in class, volunteer to answer questions
- Good at explaining ideas out loud
- Skilled at oral reports and class presentations
- Can easily be distracted due to noise

2.4 Kinesthetic, physical learners

Physical, or kinesthetic, learners use their hands, body, movement, and their sense of touch to understand things. To grasp an idea, it actually helps them to physically grab the notion – touching, feeling, and manipulating objects is a very important part of their thinking process. This type of learner has difficulty focusing on visual and oral presentations, and will become distracted or move around, as they are generally central focused. While physical learners can retain information just as well as any other learner, it is their lack of movement that inhibits them. A physical learner can study

more effectively while walking and running and finds study tools to hold help them focus.

Features of kinesthetic learners:

- Enjoys creating things with his or her hands
- Tends to remember by doing, rather than hearing or seeing
- Likes to do things rather than read about them
- Excellent physical coordination
- Attuned to the physical world around them

2.5 Cognitive type of learner

Cognitive learners are highly logical. They naturally prefer mathematical and reasoning tasks, nonverbal tasks, have difficulty with reflecting on their own thought processes, and have a natural inclination to use multimedia and IT devices effectively in learning. They are generally proficient with numbers, patterns, and relationships like cause and effect. Logic, facts, and common sense help them draw conclusions, and they base their arguments on this rather than emotion or intuition. They enjoy activities with computer games and IT technology can be a fruitful method in the learning process to get them engaged.

Cognitive learners typically:

- Excel in problem-solving skills and complex computations
- Easily recognize patterns and make connections
- Good at analyzing problems and mathematical operations

3. How PBL embraces the types of learners: integration of skills and interests for social change

The Project based learning method provides a flexible framework where students can get engaged and connect to the material through their own channel and interest. This, therefore, ensures that they stay motivated, and

the acquisition process is optimally effective as the interest itself ensures that the children can participate through their own strength, i.e., type of learner channel fueling their thirst for knowledge. It is easy to see how all these skills are essential in the integration of tasks in complex tasks and activities with social implication like the examples in the table below on the typology of projects. Each project ensures that the type of child, preschooler, learner can connect and contribute to the common objective at their own individual level through their own preferred channel and area of interest.

3.1 Types of Projects in PBL

The project method can focus on a variety of educational tasks and go very deep with research on a certain topic. It is a serious framework for significant problems and offers very thoroughly investigated solutions. The type of problem under scrutiny can take various forms, and therefore, require different approaches, which is certainly possible in the PBL method as well. The types of projects may vary from single person, individual through pair work all the way to group project, in terms of the number of students involved, or from the perspective of quality it can focus on generating a real object as a product of the project, by constructing an element that can also be symbolic of the project's function and meaning. The following forms and types of projects exist and enrich the pedagogical portfolio of any teacher using the PBL method, based on W. H. Kilpatrick's work (1918), where he classified projects on the basis of tasks involved.

Problem Project	A project that involves **investigation** and solution of practical problems (e.g., doing a project on the problem of low literacy level in a nearby village, investigating pollution problems, investigating community health problem, etc.)
Product Project	A project that involves **construction** of a useful material object or article to embody some idea or plan in external form (e.g., making a model of the wooden bridge over a local river)

Consumer Project	A project that provides opportunities for **experience** on a particular area/field and writing an account of it. (e.g., attending a festival in a village and writing an account on its aesthetic value.)
Drill Project	A project that provides opportunities for **mastery of skill or knowledge** on a particular area/field. (e.g., writing a critical analysis «on the system of government during the rule of first and second rulers»).

3.2 Principles and pedagogical purposes in the PBL method

The project method is rooted in reform pedagogy, in long-standing ideas of multimodality and pragmatism (Szécsi 2013a, 2021). Several aspects of the original philosophical movement of pragmatism advocate the applicability and practical use of teaching techniques, where the environment, outside the classroom should also be part of the learning process since that context and culture is also the environment of children. Teaching should, therefore, be realistic, not something abstract and almost laboratory-experiment like artificial setting, but something that has implications for the immediate social and interpersonal environment, and also can directly be channeled into society in order to foster social change. This stance is especially important in today's education for a better, greener future. PBL can fruitfully be used for Green Educational programs and to investigate practical and real-life problems, in order to find real-life solutions based on the community collaboration and local interests. Some principles of projects that support this general mid-term goal are the following:

— **Principle of utility**: The project work attempts to study, investigate and find a solution to a practical problem. The problem is not abstract but a concrete one which the learner can identify. The learner is convinced of the need to investigate the problem as it definitely has an impact on the life around him. Thus, the project work has utility value.
— **Principle of readiness**: The learners are allowed to choose any one from a set of problems presented. Thus, the learners are given freedom to choose the problem based on their interest. As a result, the learners show a high degree of readiness.

— **Principle of learning by doing**: This method is activity-based method, and the learners acquire the knowledge based on work and practical experience. Thus, whatever learning takes place is the by-product of the activity and this makes learning a memorable and an enriching experience.
— **Principle of freedom at work**: The teacher acts only as a guide and facilitator and the learners enjoy a high degree of freedom to choose and work on their own with least assistance from the teacher. The freedom allowed to the student facilitates the process of emotional and intellectual development in the child.
— **Principle of socialization**: The project work attempts to provide opportunities for the student to acquire social skills necessary at a later stage to move and fit into the system of society easily and profitably. The student under this method comes into contact with the social environment and during the course of active interaction with various elements of social environment acquires the social skill.

3.3 Multimodality in the Project method

The practical and applied techniques also bring us to the question of multimodality in education, which stands for the different **modalities** of human **cognition**, among them vision (seeing), auditive modality being listening skills, tactile modality referring to touching and feeling with the body and in kinesthetic ways, etc. It is easy to see the connection to the type of learner rules (above in part 2), where the modality basically determines the channel through which the child, preschooler or student can most effectively connect to the material at hand. Multimodality is also recommended in special education, with problems of behavior or in atypical development like Attention Deficit and Hyperactive Disorder, neuropsychiatric disorders like Autism Spectrum Disorder (ASD) or other mental handicaps and social-behavioral problems.

Multimodality and therefore the project-based framework in education, therefore, ensures the peaceful and democratic integration of marginalized students and children (Schnell, Podeschi 2022, Schnell, Ervas 2022),

whether their disadvantage is of racial, behavioral, mental, cultural, or psychological nature. The PBL therefore is also an effective tool to diminish cultural conflicts, problems in intercultural communication and to integrate marginalized students for any reasons. Importantly not only integration but eventually inclusion can take effect as a result of the democratic way of each student engaging through their own strengths and preferred channels as different types of learners. The use of information technology and mediatized materials in education can help teachers use the power of computer technology to spark the learner's imagination and ultimately move them toward deeper learning (Krajcsi *et al.* 2003, Schnell, Podeschi 2022).

The differences of integration and inclusion are illustrated in Fig 2. below, showing that segregation of different students is eventually not advantageous for the purposes of education, integration means the segregated acceptance of different students, but the final goal would be their inclusion in educational activities, meaning, their democratic inclusion, that they can participate as full right members as individuals in the big context of the collective, ensuring that each individual contributes to the great whole: the pedagogical objective to be reached. This collaboration is highly supported in the PBL framework where multimodality itself means colorful strategies, tools, embracing different modalities, ways to approaching, investigating interpreting, and understanding a given topic.

PBL, therefore, is a democratic way of learning. The children choose, plan, and execute the project themselves. It teaches dignity of labor, and the pupils develop respect and taste for all types of work. It affords opportunity to develop keenness and accuracy of observation and to experience the job of discovery. It helps to widen the mental horizon of pupils. Old beliefs and prejudices are overcome when children experience and analyse the problems in their natural settings. It sets up a challenge to solve a problem, which stimulates constructive and creative thinking.

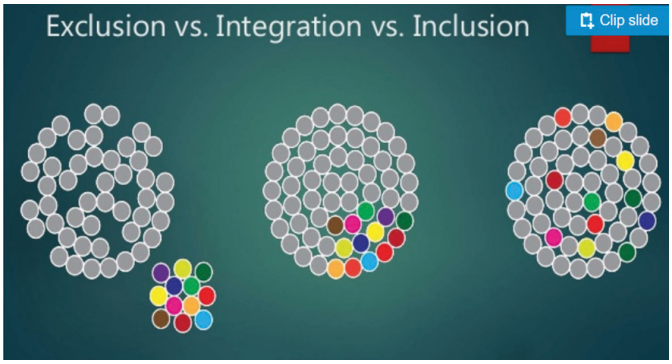

Figure 2 – Social and interpersonal processes in Education.

We should, however, also mention some challenges of the method, as we must be aware of strengths and weaknesses of all strategies and techniques in education. Such possible difficulties might be that PBL absorbs a lot of time, with the result that the quantity of knowledge suffers. The whole syllabus, especially for more advanced classes, cannot well be included in a collection of projects and it is difficult to finish the syllabus in the limited span of time.

3.4 Efficient teacher roles in the 21st-century with new generations of children

In the integration of myriads of factors and perspectives the teacher also naturally gains a new role, becoming more a facilitator of students' own ideas, helping these approaches and plans to converge in order to ensure that they will serve the purposes of the common pedagogical goal that must not be overlooked. The responsibility of the teacher is this: ensuring that the pedagogical goal is not overlooked. Below the roles of PBL teachers are summarized (Freire 1972, 1974, Deans 1999), taking on a different function in the learning process, encouraging students to find their own perspective and therefore fueling their motivation to collaborate.

— The teacher is not a commander but a friend, guide, and a working partner.

— They should provide occasions for shy pupils to come forward and contribute something towards the success of the project.
— They should help the students in developing the character and personality by allowing them to accept the responsibilities and discharge them efficiently.
— They should provide a democratic atmosphere in the class so that the pupils can express themselves fully without any fear of the teacher.
— They should be alert and active all the time to see that the project is running in its right lines.
— They should know their students to help them engage actively and optimally.
— They should have initiative, and be enthusiastic, open for questions, supporting the inquiry teaching practices.

4. Parts and stages of a Project

Projects have sets and important parts, whose order must be kept and none of the stages shall be omitted. These include setting the purpose – this is where the responsibility of the teacher is high in identifying the objective of the project and ensuring that this pedagogical goal is not overlooked throughout the learning phases. This will ensure a scaffolding for the entire process (Fig. 3).

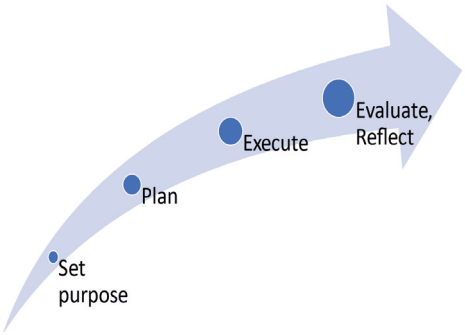

Figure 3 – Stages and parts of the project-based learning process.

Steps of the PBL method include the stage of **creating** the situation. In this phase the teacher sets up basic information about the topic and sets the stage for the collaborative work. The project should be purposeful and significant, and it should arise out of need felt by the students. It should not be forced on them.

Second phase is the **planning** stage, where selection of the problem is the first step: the teacher helps the students select a problem and guides them in finding different approaches to the topic. Students are encouraged to take initiatives with their approaches, and the teacher facilitates the brainstorming and narrowing down the topics to relevant questions, encouraging students to find approaches from different angles.

In the third phase, that of **execution**, students take action, and start work. They have to collect the relevant materials first. The teacher should give enough time and let students go according to their own speed, interest, and ability, potentially connecting each type of learner to modalities of educational materials. The teacher here ensures that the pedagogical goal is not overlooked and provides a scaffolding for the process, within which students are free to roam and find their ways of contribution but keeping the process on track for the educational objective at hand.

The last phase is **evaluation**: Evaluation of the project should be done by both the teacher and the pupils. They evaluate their work and decide if their goal has been reached or not, if their product, often the realized objective result of the project is created as they wished. The evaluation should be done in view of plans, difficulties, desired outcome and applied techniques with achieved results. Often pedagogical projects require a reporting of the fulfillments and details, especially if the project is funded.

4.1 PBL and Bloom's taxonomy – gradual scaffolding of knowledge

On the basis of this it is clear how PBL ensures the gradualness of the acquisition process, the incorporation of learned material in different levels of complexity, just as **Bloom's Taxonomy** has described scientifically (Fig. 4). Bloom gave a hierarchy of steps in the learning process, identifying the stages from simple to gradually more complex levels of organizations of mental schemes and contents of knowledge. The PBL, likewise, also represents a

systematic teaching method that engages learners in acquiring knowledge and skills through an extended inquiry process structured around complex, relevant questions, carefully designed products, and authentic tasks, just as Bloom's theory suggests the gradually increasing complexity of cognitive schemes to follow one another. As projects are problem-based tasks, focusing on authentic, real-world challenges and questions, they demand higher-order thinking to real-world contexts. This requires, trains, and involves 21st-century skills (see Fig. 1 above). Bloom suggests a gradual progress from lower order thinking skills (basic factual knowledge (e.g., the lemon is a fruit, it is yellow and edible) to higher order thinking skills like synthetizing information (lemons are edible and healthy, so I can make tea when I am ill), and evaluation. These steps in the Early Bloom scheme basically correspond to the stages of PBL methods, so project-based learning ensures a cognitively congruent process in education, and thus is effective, besides being enjoyable for students.

Bloom's model reminds teachers that learning is an active process, stressing the importance of including measurable verbs in the objectives. And the clear structure of the taxonomy itself emphasizes the importance of keeping learning objectives clear and concise as opposed to vague and abstract. Having these clear and organized objectives allows teachers to plan and deliver appropriate instruction, design valid tasks and assessments, and ensure that such instruction and assessment actually aligns with the outlined objectives (Krajcsi *et al.* 2003, Szécsi 2013a, 2013b). Overall, this model is beneficial both for student and the teacher.

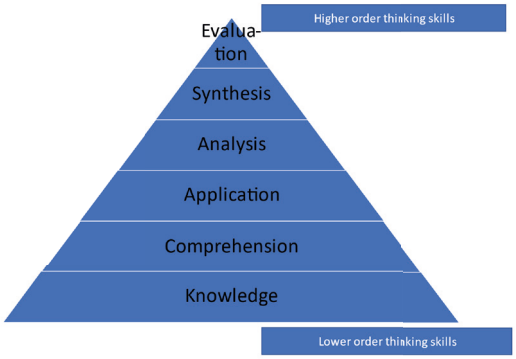

Figure 4 – Bloom's original taxonomy of the complexity of learning phases.

Later Bloom's taxonomy was revised, at the turn of the millennium, where the stages were made more refined, and the order of the top stages in the pyramid were also reversed, resulting in a final Bloom taxonomy in Fig. 5 below.

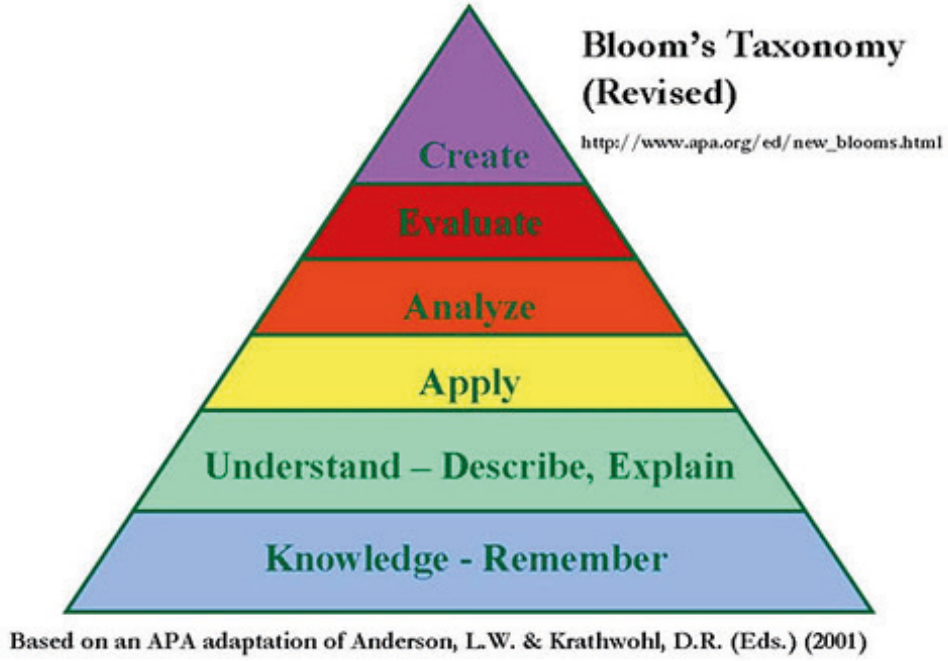

Figure 5 – Bloom's revised taxonomy (source: Anderson, Lorin, Krathwohl 2001).

In the new model evaluation is not the last phase (as in PBL) but it is followed by creation, where application in an unlimited free framework might take place and new emergent ideas can appear as a result of the learning process, yielding creative solutions to existing problems, and possible with the potential of bringing on social change – i.e., creating efficient practices to foster the protection of the environment at schools (see our Leőwey You'r Water project below in 5.2).

4.2 Information Technology (IT) skills and education today: crucial 21st-century competencies

This eventually leads us to the overlap of the 4 C's, being 21st-century skills and the enhancement of other important skills crucial for the Bloom stages as application, synthesis, analysis and evaluation. Such complex skills integrate social, communicative skills, life career skills, innovation skills and information, media and technology skills as well (Fig. 6) (Krajcsi *et al.* 2003. Szécsi 2021).

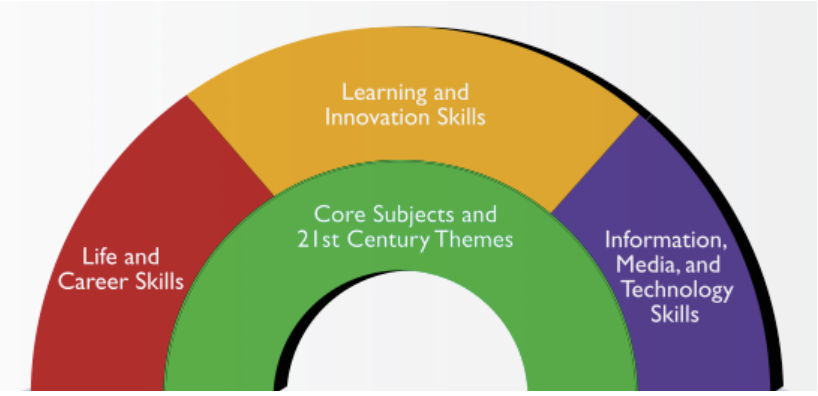

Figure 6 – Further complex skills for self-fulfillment (source: Sahito 2019, 2).

Media literacy is crucial, it is another 21st-century competence as learners rely on such higher order thinking skills when using an essential tool today in social communication: the media. People in the 21st-century live in a technology and media-driven environment, marked by access to an abundance of information, rapid changes in technology tools and the ability to collaborate and make individual contributions on an unprecedented scale. To be effective in the 21st-century, citizens and workers need to exhibit a variety of technical skills (Fig. 7).

LEVEL	DESCRIPTION	DIGITAL ACTIVITY
Remembering	Be able to retrieve information and resources	Identify a legitimate search engine, e.g. Google (www.google.com) and understand how it works
Understanding	Able to construct meaning and build relationships	Categorise and tag bookmarks through a social bookmarking application (e.g www.getpocket.com)
Application	Be able to apply learnt knowledge to a situation	Edit a wiki page, such as on Wikipedia (www.wikipedia.org)
Analysis	Determine relationships between parts and whole	Use an online survey tool (e.g. www.surveymonkey.com) to set up and conduct a survey
Evaluation	Criteria-based judgements	Moderate and respond to comments made on a blog post
Creating	Synthesise past knowledge to create a new product	Students can launch and produce their own podcast on a topic in the curriculum

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Figure 7 – Higher order thinking used in complex social and cognitive processes (source: Churches 2012, 4).

The use of information technology to support the learning process can help learners construct their own understanding. It develops higher order thinking and 21st-century skills, improves collaboration and thus fosters communication. Online thinking tools are active learning places where students can profit from IT tools to engage in robust discussions, analyze complex information, pursue investigations, and effectively solve problems.

5. Original contribution of the study – Implementation and cognitive gain

Today's educational sciences face the challenge of finding and creating a methodology that is feasible in the 21st-century, that is relevant for the new generations and serves purposes that bring on social change. The implementation of such 21st-century competencies is of key importance for today's professionals. Project pedagogy offers a framework for this need and provides several useful practices for future pedagogical methods.

5.1 Example 1 – Group project at the elementary education level – Applied aspects of PBL in practice

The class may make a project entitled 'Food in your country'. PBL will enable students to work in pairs and collaborate both at the individual level and at the collective level simultaneously. The Food project can be summarized in seven steps as Fig. 8 shows below:

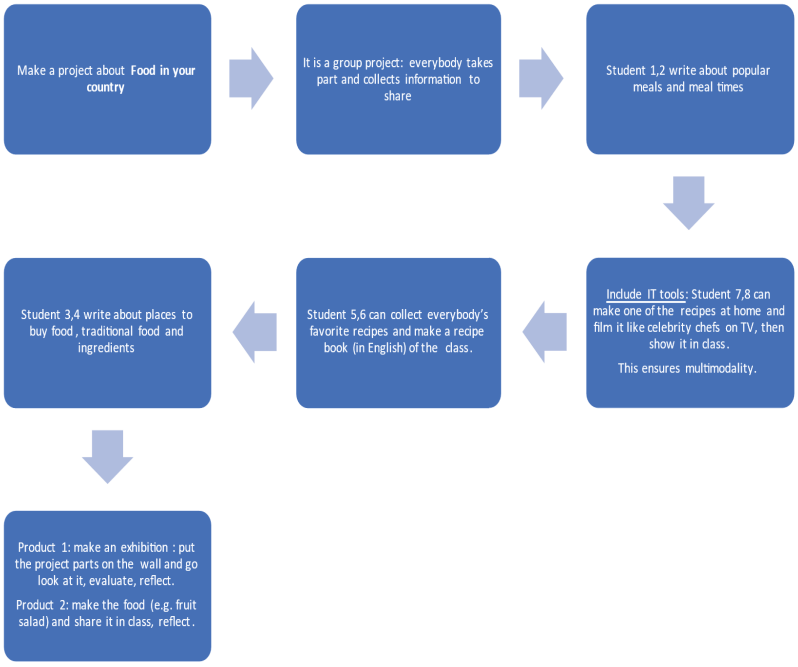

Figure 8 – Example of a group project in class – Food in your country.

5.1.1 Objectives

Objectives of this project (in line with above described general PBL goals of bettering society), included involving students in learning about foreign cultures, thus meeting specificities and special traits, customs, symbols that themselves stand for and mirror identity and cultural values.

In the process of drawing up the project, students not only gain lexical knowledge (in their mother tongue or in a foreign language), but also learn about intercultural communication, respect of differences, and gain factual knowledge about foreign cultures. This, if done in a foreign language (as in our ESL example), improves students' vocabulary and develops their communicative skills, along with enhancing their cooperativity and creativity.

5.1.2 Tools and activities

Activities included the steps described by Fig. 8. above. Students had to make a project about the food in their country. PBL allows multiple perspectives so some students may decide to write about meals and mealtimes (times can also vary across culture revealing cultural differences in time management, time concept, social activities, customs, religion, values, etc.). Some students may decide to write about popular dishes, types of seafood, taste and spices (revealing geographical, regional differences, natural resources, vitality of personality and typical aspects of cuisines). As projects always have a concrete result, and object or poster exhibition (cf. our Example 3 below), in the end students might decide to write their own recipe: name the dish/food, and write the steps of the procedure of making it.

5.1.3 Educational practices

In drawing up the project at hand, students need to go through the phases of planning, cooperativity in implementation which requires argumentation and the ability to agree, find a compromise with others, have critical thinking skills what food or recipe to choose that is appropriate for the classmates to make, and so on. Lastly it requires creativity in cooking, in using images, illustrations with colors, choosing the right technique (sticking pictures or drawing or using other art techniques).

5.1.4 Results obtained

As it is a group project, everybody takes part and engages in the activity serving the same pedagogical goal (the topic of the project). All 4 C's are made use of and can be implemented with versatility. If IT methods are

also involved, techniques make use of multimodality at a greater level, and also make independent work and cooperation (after school activities) necessary. This enhances students' responsibility in their contribution. Results include the product of the project that can take various forms: (1) an exhibition of food posters, cultural aspects of food in different cultures, (2) a collection of recipes compiled by the students, or (3) a recipe (e.g., fruit salad) made by the class together. Alternatively (4) a video of cooking the selected recipe can also be filmed and used as a video. An important part of PBL is Reflection, so in the end members always discuss experiences throughout the project, their impressions, gains, difficulties, best parts, alternative options, future solutions for problems, advice, etc.

5.2 Example 2 – PBL technique for Social change – PBL in Green education: «Y'our Water» project of Leőwey high school in Pécs

In the present article we delineate an example of PBL in modern education, building on of 21st-century competencies of children and students, and provides an example for the implementation of these in the VIZED («Y'our Water») Project of Leőwey High School in Pécs, the partner institute of the University of Pécs and our Faculty. Their project is based on constructive approaches and a collaborative stance. The practices targeted the realization of a project in the framework of environmental and health education in Leőwey High School in Pécs. The community carefully planned the basic steps and notions that ensure a valid and reliable pedagogical scheme, indispensable for the educative purpose of the PBL method.

5.2.1 Objectives

The high school project focused on green education, i.e., pedagogy that raises awareness of environmental problems and enhances students' understanding of their social responsibility in fighting the negative effects of climate change. In our study we use green pedagogy in the sense of an education emphasizing the importance of environmental protection. The present project on green education focuses on water and highlights the need for practices in order to save water. Applied aspects include special

practices that are introduced: the school set up fountains in the corridors, which were the final products, where students could fill their own water bottle produced and distributed with the school's logo. This also functioned as a teambuilding activity, creating a relaxed and cooperative environment with shared experiences and the joy of the success of common efforts to bring on social change for a better, greener future (Fig. 9).

Figure 9 – Green educational project to foster social change through education.

The skills developed and evaluated in the project, and here described, all converge to enhance 21st-century competencies with which one can educate competent individuals for the future, for life, an example of *homo studens* (Zalay 2021) aiming to raise wise and socially competent, knowledgeable individuals for life. In this, the recognition and support of individual inclinations is essential, where the educator takes the role of a moderator,

rather than providing ready baked lexical knowledge as in the traditional frontal classroom setting.

5.2.2 Tools and activities

The specific steps involved practical implications at the individual (1-person) level as well as at the community level. Students had to read the description and regulations of the real Project tender they wanted to apply for, design their own application, from exploring the background, through implementation, to financial requirements and argumentation phases. They had to write the tender, use, and apply rules and conditions described in it, and finally draw up the project.

5.2.3 Educational practices

The teacher did not have the traditional role of prescribing steps, thoughts, being the major source of information or ideas, but rather, s/he was more a mediator of processes. The teacher's function was mostly to keep the diverse ideas, viewpoints, perspectives on track, where ideas converge and serve the one pedagogical goal identified at the beginning of the project. The teacher ensures that despite great freedom in practical realization and steps of implementation (that ensures diversity and personal involvement), the one pedagogical goal is not missed but it is served by all different ideas and strategies.

5.2.4 Results obtained

This freedom and multimodality support creativity which enhances motivation. This in turn has the effect of an emerging feeling of social responsibility, which is greatly needed in education, as it has the potential of bringing on social change. Community practices enhance cooperation, and feed this 21st-centruy skill, which in turn will also support the other three C skills.

Our objectives were the raising of awareness on climate change, fighting a global challenge at the local level, and reach out to students to show their

role in this global enterprise, highlighting their **social responsibility** and power to contribute for a good cause. These aims were highly fulfilled by the tools used in the realization of the project, in a long-term manner as fountains and re-fill bottles remain a physical symbol and example of action at the personal level with an awareness of green living.

Our results highly support the objectives we had, as the green project managed to raise awareness about the importance of climate change. Our tools and activities (creating a product: plastic-bottle free school, personalized re-fill bottles and corridor fountains) themselves constitute symbols and solutions for the goal of contributing to a greener world at the personal level.

5.3 Example 3 – PBL in ESL – Teaching English as a second language for young children

This Project targets ESL, English as a second language techniques in education and allows for the personal involvement of children. The project method in ESL teaching highly supports 21st-century skills, competencies as a platform for inclusion in the classroom (Ballard 1995).

5.3.1 Objectives

PBL is especially adapted to be applied in language teaching, in understanding cultures and different cultural perspectives, and at the same time, enhancing children's skills in foreign languages.

5.3.2 Tools and activities

The use of IT tools and smart devices is especially important in this field, as students learn about other cultures and by doing so, they must encounter the culture in the real life, through firsthand experience, yet without travelling there. This is made possible by genuine videos of native speakers, their speeches and films of the countries and cultures can give the opportunity of experiencing the other culture in person, almost as if in a method of immersion. Our study with the ESL program in the

PBL method with our collaborators in early education (Schnell, Fóti, Kochné 2021) define the major principles and its connections to reform pedagogical perspectives.

5.3.3 Educational practices

The *inquisitive learning* style highly supported by the project method suggests that the teacher should take the students out of the classroom, encourage them to meet members of society, experience real-life situations and explore their true environment, in order to incorporate these experiences in the learning process. In other words, in PBL it is recommended to make use of learned materials, apply them in practice, and for that, to go out to come back inside (Mackenzie, Bathurst-Hunt 2018).

Museum pedagogy serves this purpose, which can be fruitfully used in the PBL framework. In the ZOOm-in-Project students are put into groups and get one type of animal, which they have to find in the zoo, and explore. Each group gets a questionnaire, and they have to find the answers for them in the zoo. Habitat, food, natural predators, lifestyle, like in a biology class in ESL.

5.3.4 Results obtained

As an example, we provide a synopsis of our ESL project, named the ZOOm-in-Project (Fig. 10), which offers a creative fruitful application in the foreign language classroom. Fig. 10 also shows the result, the product of the project, where students exhibit the posters that were made during the process, in groups, along their individual ideas aligning to community needs, where the teacher moderates ideas to ensure the fulfillment of the pedagogical goal.

Our objectives (learning about foreign cultures through language learning) was clearly fulfilled. Students eventually create projects about animals (reptiles vs birds, fish vs mammals), do research, find answers, integrate them and create a mind-map poster back in class with pictures (Fig. 10).

Figure 10 – Project for ESL – English as a second language for young children.

5.4 Benefits of the method, results of the integrative approach of PBL in education.

In the **elementary school** educational framework benefits stem from increased motivation, by giving freedom to creativity in the completion of the given task at hand. Such freedom of choice can generate novel ideas and contribute to successful methodologies of inquisitive learning (Mackenzie, Bathurst-Hunt 2018). *Multimodality* is also applied and thus ensures that all types of learners can get involved, therefore, it enhances the efficiency of the learning process. This methodology is especially suited for *special needs students*, while it is efficient for all students, the ones without learning

difficulty as well. Involving all our senses enhances the efficiency of teaching and is a fruitful strategy in education for all age groups.

In the **secondary school** framework, the PBL method ensures a variety of approaches. This largely enhances the applicability of the teaching strategies as PBL specifically aligns to the cognitive developmental stage of adolescents described by classical theories of cognitive development (Piaget, Inhelder 1962), demonstrating that adolescents are particularly susceptible to do *formal operations*, symbolic interpretations, generate and handle multiple approaches and select specific outcomes simultaneously. The above approach in education ensures the freedom for multiple approaches, thus enables an evaluation on the spot by the *integration of perspectives,* like a prism, and therefore also serves as a tool for the *development of the personality*, as generating multiple perspectives makes participants more open-minded to embrace different viewpoints and accept different opinions. This evaluative result is fruitful not only at the *cognitive* level but also in the development of one's *identity* and personality (Schnell, Podeschi 2022, Schnell, Ervas 2022). Beyond these general benefits, our project in Green Education ensures that we raise awareness about the protection of our environment.

In the present example we applied the PBL method to ESL techniques and used the zoo as an environment for children to connect real life experience, do explorative work, use the foreign language to ask questions, find information, get around and find sports and answer questions in a worksheet compiled by the teacher carefully. This event improved students' communication skills, and increased Student Speaking Time (SST), a key objective in ESL. Finally, they compiled an exhibition of the photos and answered worksheets that included colorful images and drawings, besides important knowledge on groups of animals and their natural habitat. The framework enhances 21st-century skills for future language users.

6. Conclusions

Some of the traditional ways of education are not relevant anymore, and new generations require an active role, an active agency and **constructive** part taking in the learning process. Our study offers guidelines to identify the **type of learner**, with their preferences and strengths for their cognitive

channels, also called modalities in the acquisition process, and techniques to apply these individual differences in the project method.

PBL improves learning as students apply classroom-knowledge to **real-world problems**. It is beneficial since a project setting requires **sustained engagement** and collaboration. Research has proved that it is **efficient** because **active**-learning impacts learner **performance** more than any other variable, including student background and prior achievement. It offers efficient educational frameworks for the new generations of children, students of all ages keen on using and understanding **information technology**, and smart devices, which can be incorporated in the PBL framework in a beneficial way. PBL also enables the **integration** of **individual** perspectives **in the collective** work simultaneously, and therefore, is a very democratic platform with an opportunity for the **inclusion** of marginalized students due to their culture, language, or other social economic circumstances. These results entail the power of **bringing on social change,** benefiting all of society and future educational purposes.

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