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PEDAGOGICAL ESSENCE OF STEAM TECHNOLOGY IN PRIMARY EDUCATION AND ITS APPLICATION IN THE TEACHING OF "TARBIYA"

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Abstract: The rapid development of science and technology and the increasing globalization of education require the modernization of educational content, teaching methods, and pedagogical approaches. In this context, steam education has emerged as an innovative interdisciplinary model that integrates science, technology, engineering, art, and mathematics into a unified educational process. This article examines the pedagogical essence, theoretical and methodological foundations, and educational potential of steam technology in primary education. Particular attention is paid to constructivist pedagogy, activity theory, and the competency-based approach as the main theoretical foundations of steam education. The article also discusses the role of steam activities in developing primary school pupils' critical and creative thinking, problem-solving, research, communication, and collaboration skills. Furthermore, opportunities for applying steam technology in teaching the subject "tarbiya" are considered. It is argued that project-based tasks, experimentation, modelling, construction activities, interactive games, and environmentally oriented projects can contribute to the development of pupils' intellectual, social, moral, and practical competencies. The study concludes that the effective integration of steam principles into primary education can create an active, learner-centred, practice-oriented, and interdisciplinary learning environment.

Keywords: steam education, primary education, interdisciplinary learning, innovative pedagogical technology, constructivism, activity theory, competency-based approach, critical thinking, creative thinking, problem-solving, tarbiya.

BOSHLANG'ICH TA'LIMDA STEAM TEXNOLOGIYASINING PEDAGOGIK MOHIYATI VA UNI "TARBIYA" FANINI O'QITISHDA QO'LLASH

Annotatsiya: Jahon ta'lim tizimida globallashuv jarayonlarining jadallashuvi hamda ilm-fan va texnologiyalarning rivojlanishi ta'lim mazmuni, metodlari va pedagogik yondashuvlarni takomillashtirish zaruratini yuzaga keltirmoqda. Shu nuqtayi nazardan steam ta'limi science, technology, engineering, art va mathematics yo'nalishlarini yagona ta'lim jarayoniga integratsiyalovchi innovatsion fanlararo model sifatida muhim ahamiyat kasb etadi. Mazkur maqolada boshlang'ich ta'limda steam texnologiyasining pedagogik mohiyati, nazariy-metodologik asoslari hamda ta'limiy imkoniyatlari tahlil qilinadi. Steam ta'limining asosiy nazariy manbalari sifatida konstruktivistik pedagogika, faoliyat nazariyasi va kompetensiyaviy yondashuvga alohida e'tibor qaratiladi. Shuningdek, steam faoliyatining boshlang'ich sinf o'quvchilarida tanqidiy va kreativ fikrlash, muammolarni hal qilish, tadqiqotchilik, muloqot va hamkorlik ko'nikmalarini rivojlantirishdagi o'rni yoritiladi. "tarbiya" fanini o'qitishda loyiha topshiriqlari, tajriba-sinov ishlari, modellashtirish, konstruktorlik faoliyati, interfaol o'yinlar va ekologik loyihalardan foydalanish imkoniyatlari ko'rib chiqiladi. Steam tamoyillarining boshlang'ich ta'limga samarali integratsiyasi faol, o'quvchiga yo'naltirilgan, amaliy va fanlararo ta'lim muhitini shakllantirishga xizmat qilishi asoslanadi.

Kalit so‘zlar: steam ta’limi, boshlang‘ich ta’lim, fanlararo integratsiya, innovatsion pedagogik texnologiya, konstruktivizm, faoliyat nazariyasi, kompetensiyaviy yondashuv, tanqidiy fikrlash, kreativ fikrlash, muammolarni hal qilish, tarbiya.

ПЕДАГОГИЧЕСКАЯ СУЩНОСТЬ STEAM-ТЕХНОЛОГИИ В НАЧАЛЬНОМ ОБРАЗОВАНИИ И ЕЁ ПРИМЕНЕНИЕ В ПРЕПОДАВАНИИ ПРЕДМЕТА «ВОСПИТАНИЕ»

Аннотация: Ускорение процессов глобализации образования, а также стремительное развитие науки и технологий обусловливают необходимость совершенствования содержания, методов и педагогических подходов в современной системе образования. В данном контексте steam-образование приобретает особое значение как инновационная междисциплинарная модель, объединяющая science, technology, engineering, art и mathematics в едином образовательном процессе. В статье рассматриваются педагогическая сущность, теоретико-методологические основы и образовательный потенциал steam-технологии в начальном образовании. Особое внимание уделяется конструктивистской педагогике, теории деятельности и компетентностному подходу как основным теоретическим основам steam-образования. Анализируется роль steam-деятельности в развитии критического и творческого мышления, навыков решения проблем, исследовательских способностей, коммуникации и сотрудничества учащихся начальных классов. Рассматриваются возможности применения проектных заданий, экспериментов, моделирования, конструкторской деятельности, интерактивных игр и экологических проектов при преподавании предмета «воспитание». Делается вывод о том, что эффективная интеграция принципов steam в начальное образование способствует созданию активной, практико-ориентированной, междисциплинарной и личностно-ориентированной образовательной среды.

Ключевые слова: steam-образование, начальное образование, междисциплинарное обучение, инновационная педагогическая технология, конструктивизм, теория деятельности, компетентностный подход, критическое мышление, творческое мышление, решение проблем, воспитание.

Introduction

Education today is changing alongside society. Advances in technology, growing access to information, and new social expectations mean that schools can no longer focus only on giving pupils theoretical knowledge. Children also need to learn how to think independently, communicate their ideas, work with others, solve problems, and use what they have learned in everyday situations.

These skills are especially important in primary education. The early school years shape not only children's academic knowledge but also their curiosity, confidence, creativity, and attitudes towards learning. Young children naturally want to explore the world around them. They ask questions, observe what happens, experiment with objects, and learn through practical experience. For this reason, teaching approaches that allow children to discover knowledge rather than simply receive it from the teacher are particularly valuable at this stage.

STEAM education provides such an opportunity. It brings together Science, Technology, Engineering, Art, and Mathematics and encourages pupils to use knowledge from these areas to understand and solve real-life problems. Rather than treating each school subject as a separate area of knowledge, STEAM helps children see how different subjects are connected.

The purpose of this article is to explore the pedagogical value of STEAM education in primary schools, discuss its theoretical foundations, and consider how it can contribute to the development of pupils' key competencies. Particular attention is given to the possibilities of integrating STEAM activities into "Tarbiya" lessons.

The Pedagogical Value of STEAM Education

STEAM is more than simply teaching science, technology, engineering, art, and mathematics in the same classroom. Its real value lies in connecting these areas through meaningful tasks, projects, experiments, and problems that children can understand and relate to.

Each element of STEAM makes a particular contribution to learning. Science encourages children to observe and explore the natural world. Technology introduces them to different tools and ways of using them. Engineering teaches pupils to design, build, test, and improve their ideas. Art gives them space for imagination and creative expression, while mathematics develops logical and analytical thinking.

When these areas are brought together, learning becomes more meaningful. A child may understand a mathematical idea more clearly when it is needed to build a model or complete a project. Similarly, a scientific concept may become easier to understand when pupils can observe it through an experiment rather than simply read about it in a textbook.

This is one of the main differences between STEAM and more traditional forms of instruction. In a conventional classroom, pupils may receive information and then reproduce it in exercises or tests. In a STEAM-based lesson, they are more actively involved. They ask questions, investigate problems, try different solutions, make mistakes, improve their work, and explain what they have discovered.

Such learning gives children a sense of ownership over their education. Knowledge is no longer something that is simply given to them; it becomes something they discover and use.

Practical learning is particularly important for younger pupils. Children often understand ideas more easily when they can see, touch, build, draw, compare, and experiment. STEAM creates opportunities for exactly this kind of learning and therefore makes abstract ideas more accessible and meaningful.

Theoretical Foundations of STEAM Education

The educational principles behind STEAM are closely related to several well-established approaches in pedagogy. Constructivism, activity-based learning, and competency-based education are particularly relevant.

Constructivist Learning

From a constructivist perspective, children do not simply receive knowledge from teachers. They gradually build their own understanding through experience, interaction, observation, and reflection. Piaget (1972) emphasised the active role of the learner in cognitive development, while Vygotsky (1978) drew attention to the importance of communication and social interaction in learning.

STEAM lessons naturally reflect these principles. Instead of immediately providing an answer, the teacher can introduce a problem and allow pupils to explore it.

For example, pupils might be asked to examine how much waste is produced in their classroom during one school day. They could separate the waste into different categories, compare the amount of paper and plastic, discuss which materials can be recycled, and then suggest ways to reduce classroom waste.

A simple activity of this kind brings several areas of learning together. Children observe and classify materials, use basic mathematical skills, think about possible solutions, design ideas, and discuss environmental responsibility. More importantly, they reach conclusions through their own activity.

Learning Through Activity

Children often learn best by doing. When they build something, conduct a simple experiment, create a model, or solve a practical problem, abstract knowledge becomes connected to direct experience.

This principle is central to STEAM education. Pupils are encouraged to experiment, construct, observe, design, and test their ideas.

Building a simple model, for example, is not only a creative activity. During the process, children have to make decisions about materials, size, shape, and structure. If their first design does not work, they need to understand why and find another solution.

In this context, making a mistake is not necessarily a negative outcome. It can become an important part of learning. Pupils discover that an unsuccessful attempt can provide useful information and help them improve their next attempt. This also encourages persistence and confidence.

Competency-Based Learning

Modern education is increasingly concerned with what learners can actually do with their knowledge. Knowing facts remains important, but pupils should also be able to use their knowledge in unfamiliar and practical situations.

STEAM supports this goal because most STEAM activities require several skills at the same time. Pupils may need to collect information, compare possible solutions, make decisions, explain their ideas, work with classmates, and evaluate the final result.

As a result, STEAM education can support the development of a wide range of competencies, including critical thinking, creativity, communication, teamwork, problem-solving, research skills, digital literacy, and independent learning.

STEAM and the Development of Primary School Pupils

Primary school children are naturally curious. They are interested in discovering how things work and often learn through direct contact with the world around them. Visual materials, games, experiments, construction activities, and practical tasks can therefore be particularly effective for this age group.

STEAM builds on this natural curiosity. Instead of asking pupils only to remember information, it gives them reasons to ask questions such as “Why does this happen?”, “What will happen if we change this?”, “Can we build it differently?” or “Is there another solution?”

Observation is an important part of this process. When pupils learn to observe carefully, they begin to notice details, similarities, differences, and patterns. They can then compare what they see and think about possible causes.

Modelling also plays an important role. Some ideas can be difficult for young children to understand only through verbal explanation. A simple visual or physical model can make the same idea much clearer. Through models, children gradually move from concrete experiences towards more abstract forms of thinking.

Project work adds another dimension to learning. Even a small classroom project requires pupils to plan, make choices, share responsibilities, use materials carefully, and present a result. When children work together, they also learn to listen to other opinions, explain their own ideas, negotiate, and take responsibility for their part of the task.

Developing Critical and Creative Thinking

One of the strengths of STEAM education is that it encourages critical and creative thinking at the same time.

Critical thinking helps children examine information, ask questions, compare ideas, and decide which solution is most suitable. Creative thinking encourages them to imagine new possibilities and develop original ideas.

These two forms of thinking naturally come together in STEAM activities.

For example, pupils may be asked to create something useful from recyclable materials. First, they have to examine the materials available to them and think about their properties. Then they decide what they could create, make a simple plan, and build their product. Once it is finished, they need to decide whether it works as expected and consider what could be improved.

During this process, creativity helps them generate ideas, while critical thinking helps them evaluate those ideas. Children therefore learn that a good solution is often developed gradually through imagination, testing, evaluation, and improvement.

Integrating STEAM into "Tarbiya" Lessons

Although STEAM is often associated with science and mathematics, its principles can also be used effectively in subjects concerned with personal and social development. "Tarbiya" is particularly suitable for such integration because it aims to develop moral values, social responsibility, environmental awareness, citizenship, and positive personal qualities.

Environmental education provides a clear example. Instead of only telling pupils that protecting nature is important, the teacher can involve them in a practical project.

Children might identify an environmental problem in their school, classroom, or neighbourhood. They could observe the problem, discuss why it occurs, collect simple information, and suggest possible solutions. The activity could finish with posters, models, presentations, or practical actions.

Recycling projects are another useful example. Pupils can collect safe recyclable materials such as paper, cardboard, or plastic bottles and use them to create useful or decorative objects.

Such an activity naturally combines several aspects of STEAM. Children learn about materials through science, use measurement through mathematics, apply basic engineering principles while constructing an object, and express creativity through art. At the same time, the objectives of "Tarbiya" are addressed through discussions about environmental responsibility, careful use of resources, teamwork, and respect for the environment.

In this way, children do not simply hear about responsibility—they practise it. They do not only discuss cooperation—they experience what it means to work together towards a common goal.

This connection between knowledge and personal experience makes STEAM particularly valuable for "Tarbiya" lessons.

The Changing Role of the Teacher

STEAM education also changes the role of the teacher. In a traditional lesson, the teacher may explain a topic and pupils are expected to listen, remember, and reproduce the information. In a STEAM learning environment, the teacher has a more flexible role.

The teacher becomes an organiser and guide who creates situations in which children can explore and discover. This includes choosing meaningful problems, preparing suitable materials, asking guiding questions, supporting pupils when necessary, and encouraging them to reflect on their work.

At the same time, children need enough freedom to make their own decisions. If the teacher provides every step and every answer, pupils have little opportunity to develop independence or problem-solving skills.

Teachers therefore need to find a balance between guidance and independence.

Planning is equally important. A successful STEAM lesson should not bring different subjects together simply for the sake of integration. The connections between them should be natural and relevant to the problem being explored.

Assessment should also go beyond evaluating the final product. The process itself matters. Teachers can observe how pupils participate, cooperate with others, respond to difficulties, explain their decisions, generate ideas, and improve their work. In this way, assessment becomes part of the learning process rather than simply a final judgement.

Discussion

STEAM has considerable potential in primary education because it combines several elements that are important for young learners: curiosity, creativity, practical activity, communication, and problem-solving.

Children are generally more motivated when they can understand why they are learning something and when they can connect classroom activities with their own experiences. STEAM provides this connection by placing knowledge in meaningful contexts.

However, simply adding experiments, computers, or construction materials to a lesson does not automatically make it STEAM education. Effective STEAM learning requires purposeful interdisciplinary connections and genuine pupil participation.

Teachers also need appropriate methodological preparation. They should understand how to design age-appropriate problems, organise collaborative activities, guide inquiry without controlling every step, and assess both the learning process and its outcomes.

Within “Tarbiya”, these principles are especially valuable because the subject deals not only with what children know but also with how they behave and interact with the world around them. Practical environmental and social projects allow pupils to experience responsibility, cooperation, initiative, and respect in real situations.

Conclusion

STEAM education offers a practical and meaningful way of enriching primary education. By connecting science, technology, engineering, art, and mathematics around real-life problems, it gives children opportunities to explore, experiment, create, communicate, and find solutions.

Its value lies not only in helping pupils understand academic content. STEAM can also develop curiosity, independence, creativity, critical thinking, communication, teamwork, responsibility, and confidence.

These qualities are particularly important during the primary school years, when children are developing their attitudes towards learning and beginning to understand their role within society.

The integration of STEAM into “Tarbiya” lessons is therefore particularly promising. Environmental projects, recycling activities, collaborative tasks, creative design, and problem-solving situations can connect academic learning with moral and social education. Pupils can learn

about responsibility by taking responsibility, understand cooperation by working together, and develop environmental awareness by addressing real environmental issues.

For this reason, STEAM should not be viewed simply as another teaching technique. When thoughtfully applied, it can help create a classroom in which children are active participants in learning and where knowledge, creativity, practical experience, and social values naturally come together.

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