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THE IMPORTANCE OF VISUAL AIDS AND INTERACTIVE METHODS IN ENHANCING THE EFFECTIVENESS OF TEACHING NATURAL SCIENCES IN INCLUSIVE CLASSES

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Abstract

This article examines the methodological importance of visual aids and interactive methods in teaching natural sciences in inclusive classes. It proposes ways to connect scientific concepts with accessible representations, practical investigation, collaborative discussion, and supported explanation. Particular attention is given to selecting scientifically accurate materials, addressing sensory and communication barriers, and maintaining clear learning objectives. Examples illustrate the coordinated use of objects, diagrams, models, demonstrations, and group activities. The article considers educational practice in Uzbekistan and the professional preparation of future teachers at pedagogical universities. It is conceptual and methodological, reporting no classroom intervention or measured improvement in achievement. Its contribution is an adaptable framework for planning instruction and assessing scientific understanding across different participation formats.

Keywords: Inclusive education, natural sciences, visual aids, interactive methods, scientific understanding, accessible materials, practical investigation, collaborative learning, differentiated support, formative assessment.

Introduction

INKLYUZIV SINFLARDA TABIIY FANLARNI O‘QITISH SAMARADORLIGINI OSHIRISHDA KO‘RGAZMALI VOSITALAR VA INTERAKTIV METODLARNING AHAMIYATI

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Annotatsiya:

Mazkur maqolada inklyuziv sinflarda tabiiy fanlarni o'qitishda ko'rgazmali vositalar va interaktiv metodlarning metodik ahamiyati ko'rib chiqiladi. Ilmiy tushunchalarni o'quvchilar uchun qulay tasvir va modellar, amaliy tadqiqot, hamkorlikdagi muhokama hamda pedagogik yordam asosida tushuntirish bilan bog'lash usullari taklif etiladi. Ilmiy jihatdan aniq materiallarni tanlash, sezgi orqali axborotni qabul qilish va muloqotdagi to'siqlarni bartaraf etish hamda aniq o'quv maqsadlarini saqlashga alohida e'tibor qaratiladi. Misollar orqali predmetlar, diagrammalar, modellar, namoyishlar va guruhli faoliyatdan uyg'un foydalanish ko'rsatiladi. Maqolada O'zbekistondagi ta'lim amaliyoti va pedagogika oliy ta'lim muassasalarida bo'lajak o'qituvchilarni kasbiy tayyorlash masalalari yoritiladi. Maqola konseptual va metodik xususiyatga ega bo'lib, unda sinf sharoitida o'tkazilgan pedagogik tajriba yoki o'zlashtirish darajasidagi o'lgangan yaxshilanishlar keltirilmaydi. Uning ahamiyati ta'limni rejalashtirish va turli ishtirok shakllari orqali ilmiy tushunchalarni anglash darajasini baholash uchun moslashtiriladigan metodik asosni taqdim etishdan iborat.

Kalit so'zlar: Inklyuziv ta'lim, tabiiy fanlar, ko'rgazmali vositalar, interaktiv metodlar, ilmiy tushunchalarni anglash, o'quvchilar uchun qulay materiallar, amaliy tadqiqot, hamkorlikda o'rganish, differensial yordam, shakllantiruvchi baholash.

Introduction

Teaching natural sciences requires students to connect observations with concepts, explanations, and evidence. Many scientific processes cannot be understood through verbal descriptions alone, particularly when learners encounter unfamiliar terminology or relationships between several variables. Visual aids can make selected features visible, while interactive methods provide opportunities to question, investigate, and discuss their meaning. Their educational value nevertheless depends on purposeful selection and appropriate teaching support.

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Inclusive classes bring together students with different communication resources, sensory access needs, prior knowledge, and preferred ways of participating. A diagram that assists one learner may remain inaccessible to another. Similarly, group discussion does not guarantee participation when instructions, roles, or response formats create barriers. Teachers therefore need to combine representations and interaction with adaptations that preserve scientific objectives.

In Uzbekistan, natural science lessons can draw on familiar plants, everyday materials, local surroundings, and available classroom resources. Effective planning should consider accuracy, accessibility, safety, and opportunities for explanation rather than the attractiveness of materials alone. Pedagogical universities have an important role in preparing teachers to make these decisions. This article examines how visual aids and interactive methods can be coordinated in inclusive instruction, offering methodological examples and assessment considerations without claiming evidence from an implemented intervention.

Main part

Planning begins with identifying the scientific concept and the evidence students should use to explain it. Teachers then select representations that make relevant relationships understandable. Objects, photographs, diagrams, and models serve different purposes and should not be treated as interchangeable decorations. A photograph may show observable plant features, while a diagram can organise information about their functions. Models require explanation of both their usefulness and limitations. Teachers should check that simplified representations do not introduce misconceptions, particularly when scale, movement, sequence, or relationships differ from the actual phenomenon being studied.

Accessibility requires more than enlarging an image. Teachers can provide verbal descriptions, clear labels, tactile materials where appropriate, and alternative ways to explore information. Colour should not be the only means of distinguishing categories or stages. Diagrams need sufficient contrast and manageable detail, while instructions should use understandable language

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without removing essential scientific meaning. Students may need additional time to examine materials or connect them with explanations. Adaptations should respond to observed needs rather than assumptions based on diagnoses. The same learning objective can often be approached through several accessible representations and response formats.

Interactive methods help students use representations to develop and examine explanations. During guided observation, students can describe what they notice, compare examples, and identify questions requiring further investigation. Teachers should distinguish observations from interpretations and invite reasoning rather than accept unsupported guesses as established facts. For example, students examining leaves may compare shape and texture before discussing possible functions. Pair discussion, supported choices, and practical demonstration offer alternative participation routes. Teachers need to monitor whose ideas are heard and ensure that confident speakers do not routinely determine the group's explanation.

Practical investigations can combine visual guidance with collaborative activity. When exploring which materials dissolve in water, students may follow picture supported instructions, observe changes, record results, and discuss findings. Materials and procedures must be selected for safety, with relevant school arrangements followed. Flexible roles can include handling equipment, observing, recording, or explaining, but assignments should not permanently restrict particular students. Teachers provide necessary assistance while preserving opportunities for independent reasoning. Results should be interpreted within the conditions investigated; one classroom activity does not justify conclusions about all substances or every possible experimental situation. Assessment should examine scientific understanding across accessible response formats. Students may explain a diagram orally, arrange sequence cards, demonstrate a process, or produce a written account, depending on the objective. Teachers should distinguish conceptual understanding from reading, writing, or drawing proficiency when these are not the intended outcomes. Observations should record assistance and identify misconceptions requiring further teaching. At pedagogical universities, students can practise selecting aids, adapting investigations, and evaluating explanations. Future research should examine

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feasibility and learning outcomes before attributing improved effectiveness to these proposed arrangements. It should also consider preparation time, resource availability, equitable participation, and whether students apply understanding beyond the original activity. Such evidence would support refinement of inclusive natural science teaching within varied classroom conditions.

Conclusion

Visual aids and interactive methods offer complementary opportunities to make scientific concepts accessible and support meaningful participation in inclusive classes. Their value depends on scientific accuracy, clear objectives, appropriate adaptations, and opportunities for students to explain evidence. Materials should clarify relationships, while interaction should enable questioning and reasoning. Teachers need to consider sensory access, communication, safety, and individual support when organising observations and investigations. Flexible response formats can reveal understanding without allowing unrelated literacy or drawing difficulties to dominate assessment. Participation and assistance should be documented alongside accuracy.

For pedagogical universities in Uzbekistan, teacher preparation should include analysing representations, designing accessible activities, and interpreting student explanations. This article provides methodological proposals rather than verified findings about effectiveness. Further empirical investigation should examine feasibility, equitable participation, conceptual learning, and transfer across tasks. Evidence from such studies would inform responsible adaptation and refinement of visual and interactive approaches within inclusive natural science education.

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