



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** Didaktika fizike 1 s praktikumom  
**Course title:** Didactics of physics 1 with practicum

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester
Enovit magistrski študijski program druge stopnje Predmetni učitelj	/	3, 4	5, 7
Five-year master's degree program Subject Teacher	/		

**Vrsta predmeta / Course type**

Obvezni / Compulsory

**Univerzitetna koda predmeta / University course code:**

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
60			45		135	8

**Nosilec predmeta / Lecturer:**

Robert Repnik

**Jeziki / Predavanja / Lectures:** slovenski / Slovenian

**Languages: Vaje / Tutorial:** slovenski / Slovenian

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

**Prerequisites:**

Pogojev ni. Priporočljiva znanja: osnovne veščine iz varnega laboratorijskega dela in iz osnovnih področij fizike ter iz splošne didaktike.

None.

Recommended knowledge are: basic skills of safe laboratory work, basic knowledge of physics and of general didactics.

### Vsebina:

#### Predavanja

- Načrt dela, cilji pouka fizike, kompetence učiteljev fizike v osnovni šoli;
- zgodovina fizike in fizikalnega izobraževanja.
- didaktični elementi izvajanja pouka fizike v osnovni šoli, teorije poučevanja in pouk fizike v osnovni šoli;
- učni načrt in učna gradiva za pouk fizike v osnovni šoli
- učne metode in oblike pouka fizike v osnovni šoli
- eksperimentalni in problemski pouk fizike v osnovni šoli
- priprava na pouk fizike v osnovni šoli in evalvacija;
- preverjanje in ocenjevanje znanja fizike v osnovni šoli;
- učni prostori za pouk fizike v osnovni šoli;
- učila in učni pripomočki za pouk fizike v osnovni šoli ;
- izobraževalna tehnologija pri pouku fizike v osnovni šoli;
- IKT pri pouku fizike v osnovni šoli;
- sodobni trendi in projekti poučevanja fizike v osnovni šoli.
- osnove varnega in didaktično ustreznega laboratorijskega dela v osnovni šoli. Kvalitativne in kvantitativne meritve, specifične samostojnega in skupinskega eksperimentalnega dela. Opremljenost fizikalnega kabineta in učilnice za laboratorijsko delo v osnovni šoli, prva pomoč ob nesrečah, varnostna pravila. Ergonomija šolskega eksperimentalnega delovnega mesta.

LV:

### Content (Syllabus outline):

#### Lectures

- Learning and working plan, goals in physics education, competences of physics teacher in primary education;
- physics history and history of physics education;
- didactic elements of physics education in primary education, theories of teaching and physics education in primary education;
- physics curriculum and educational resources in primary physics education;
- education methods and forms in primary physics education.
- problem solving and experimental physics teaching in primary education;
- lesson planning on physics in primary education and evaluation;
- checking and assessment of knowledge in primary physics education
- didactic places for teaching physics in primary physics education
- teaching aids and accessories for primary physics education;
- educational technology in primary physics education
- ICT in primary physics education;
- contemporary trends and projects of primary physics education.
- basics of safe and didactical adequate laboratory work in elementary school. Qualitative and quantitative measurements, specifics of a autonomous and group experiment. Equipment of physics cabinet and classrooms for laboratory work in elementary school, emergency first aid, safety rules. Ergonomics of school experimental workplace.

LW:

Izvedba kvalitativnih in kvantitativnih meritev:

- izvedba demonstracijskega, skupinskega in samostojnega domačega (kuhinjska fizika) eksperimentalnega dela na primerih iz fizikalnih področij, predvidenih v učnem načrtu in potrjenih učbenikih za osnovno šolo
- nivojsko izvajanje eksperimentalnega dela, diferenciacija in individualizacija pri osnovnošolskem fizikalnem eksperimentiranju
- problemska zasnovanost eksperimentalnega dela, vloga podpornih materialov in aktivnosti pri tem (navodila za delo, navodila za uporabo pripomočkov, učni in delovni listi, razlaga in razgovor...)
- vloga priprave na izvedbo vaj, razdelitev dela v skupini
- pisno in verbalno poročanje o rezultatih
- razvoj različnih taksonomskih globin znanj ob pripravi in izvajanju eksperimentalnega dela
- uporaba posameznih elementov fizikalne eksperimentalne opreme, uporaba zbirk in priročne opreme
- uporaba računalnika, vmesnikov, senzorjev, druge IKT in multimedijske opreme pri eksperimentalnem delu v osnovni šoli

Projektna naloga:

- Samostojno delo: zasnovati in pripraviti motivativno eksperimentalno vajo, izvesti vajo in poročilo o vaji, pripraviti navodila in varnostna opozorila, vajo predstaviti strokovni in laični javnosti ter odgovarjati na vprašanja, uporaba IKT.

Implementation of qualitative and quantitative measurements:

- Implementation of a demonstrational, group and autonomous home- (kitchen physics) experimental work on cases of physical fields provided in the curriculum and approved textbooks for elementary school
- Level based implementation of experimental work, individualisation and differentiation in physics experimentation in elementary school
- Problem-based experimental work, the role of supporting materials and activities (work instructions, instructions for use of devices, learning- and worksheets, interpretation and discussion...)
- The role of the preparations for the execution of exercises, the division of labor work within the group
- Written and verbal reporting of results
- Development of different taxonomical depths of knowledge in preparation and implementation of experimental work
- Use of individual components of physics experimental equipment, the use of experimental sets and handy equipment
- Use of computer, interfaces, sensors and other ICT and multimedia equipment in the experimental work in elementary school.

Project work:

- Autonomous work: to design and prepare a motivative experimental exercise, execute and prepare report, prepare instructions and safety warnings, present exercise to professional and lay public and to answer questions, use of ICT.

**Temeljna literatura in viri / Readings:**

**Osnovno / primary:**

- R. Repnik et al., Didaktika fizike 1 s praktikumom: zbirka laboratorijskih vaj.
- Gerlič. Didaktika pouka fizike v OŠ. PEF MB, 1992.
- Gerlič, V. Udir. Problemski pouk fizike v OŠ. Zavod RS zašolstvo, Ljubljana, 2006.
- Gerlič. Sodobna informacijska tehnologija v izobraževanju. DZS, Ljubljana, 2000.
- Veljavni predmetniki, učni načrti, učbeniki, priročniki, delovni zvezki, didaktični kompleti in ostalo didaktično gradivo za pouk fizike v osnovnih šolah/syllabuses, learning plans, textbooks, handbooks, didactic materials for teaching in primary schools
- Revije: Fizika v šoli, Presek, Življenje in tehnika. Physics Teacher, Physics Education.
- E-študijska gradiva na spletnih straneh FNM UM

**Dodatno / secondary:**

- Barica M. Požarnik. Kakršno vprašanje, takšen odgovor. IMPRESUM Zavod RS za šolstvo, Ljubljana 1980
- Franc Strmčnik. Problemski pouk v teoriji in praksi. Didakta, Radovljica 1992
- France Strmčnik. Sodobna šola v luči učne diferenciacije in individualizacije. ZOTKS, Ljubljana 1987
- Blažič, M., Ivanuš Grmek, M., Kramar, M., Strmčnik, F. (2003). Didaktika. Visokošolski učbenik. Novo mesto: Visokošolsko središče, Inštitut za raziskovalno in razvojno delo.
- Navodila za izvedbo vaj/ Guidelines for the laboratory work
- Znanstveni in strokovni članki v znanstvenih in strokovnih revijah / Scientific and technical papers in scientific and technical journals
- J. Strnad, Fizika, 1. in 2. del, (DMFA, Ljubljana, 2002)
- Na spletnih straneh Oddelka za fiziko objavljena elektronska gradiva./ teaching material published on websites of Department of Physics
- Didaktična gradiva projekta Razvoj naravoslovnih kompetenc /Didactic materials of the project Development of natural science competences

**Cilji in kompetence:**

Študent usvoji specialna fizikalna, didaktična, pedagoška in psihološka znanja potrebna za učinkovito poučevanje fizike v osnovni šoli s fokusom na fizikalno eksperimentalnem delu v osnovni šoli.

**Objectives and competences:**

Student adopts special physics, didactic, pedagogical and psychological knowledge for effective classroom physics teaching in primary schools with focus on experimental work in primary schools.

**Predvideni študijski rezultati:****Znanje in razumevanje:**

Po uspešno zaključeni učni enoti je študent zmožen:

**Intended learning outcomes:****Knowledge and understanding:**

On completion of this course student will be able to:

- know and understand theoretical platforms of primary school physics teaching,

- poznati in razumeti teoretična izhodišča poučevanja osnovnošolske fizike;
- spoznati in razumeti učne načrte in obstoječa učna gradiva za pouk fizike v osnovnih šolah;
- obravnavati pomembne didaktične in fizikalne razvojne koncepte osnovnošolske fizike;
- znati poiskati in se usposobiti za aktivno udeležanje osnovnošolske zakonodaje;
- spoznati možnosti uporabe IKT pri pouku fizike.
- načrtovati in znati uporabljati različne učne oblike in metode dela in jih vključiti v pouk fizike v osnovni šoli;
- sinteze znanja za načrtovanje in izvedbo nastopa pred učenci in druge nastopne aktivnosti,
- evalvacije nastopa in ocenjevanja znanja "učencev" osnovne šole.

**Prenesljive/ključne spretnosti in drugi atributi:**

Študent usvoji spretnosti varnega snovanja in izvajanja eksperimentalnih vaj, razvija strokovno in informacijsko pismenost, usvoji kompetenco pisnega in verbalnega izražanja pred strokovno in laično javnostjo, predvsem podajanje znanja za različne razvojne stopnje.

**Metode poučevanja in učenja:**

Multimedijska predavanja, razgovor in diskusija, demonstracija, metoda pisnih in grafičnih del, uporaba IKT, reševanje problemskih nalog in preiskovanje, ustvarjanje avtentičnih učnih situacij (mikro pouk), oblike dela (individualno delo, skupinsko delo - kooperativno učenje, timsko delo, delo v dvojicah, frontalno delo), delo z viri. Vodeno eksperimentalno delo. Samostojno terensko in laboratorijsko delo.

Poučevanje in učenje potekata z didaktično uporabo informacijsko-komunikacijske tehnologije.

- know and understand physics curricula and learning materials in primary schools,
- master some specific didactics and physics developing concepts of primary school physics,
- find and qualify for active implementation of primary school legislation,
- know and apply different possibilities of ICT in physics education.
- plan and use different methods and forms of teaching and imply them to physics class in primary school,
- synthesize knowledge to plan and execute class performance and other performance activities,
- evaluate class performance and assess student knowledge.

**Transferable/Key Skills and other attributes:**

Student adopts the skills of safe design and implementation of experimental exercises, develops professional and informational literacy, adopts the competence of written and verbal expression in front of the professional and non professional public, and in particular providing knowledge for various stages of development.

**Learning and teaching methods:**

Multimedia lectures, conversation and discussion, demonstration, method of written and graphic products, usage of ICT, problem solving and investigation, creation of authentic learning situations (micro teaching), learning forms (individual work, teamwork, group learning (cooperative learning, work in pair, frontal instruction), work with sources. Guided experimental work. Autonomous field and laboratory work.

Teaching and learning are done through the didactic use of ICT.

**Načini ocenjevanja:****Weight (in %)****Assessment:**

<ul style="list-style-type: none"> <li>- Portfolio s pisnimi izdelki (učne priprave, analize praktičnega pedagoškega dela, praktično pedagoško delo)</li> <li>- Opravljene laboratorijske vaje (priprave na vajo, izdelano poročilo laboratorijskih vaj ter zagovor, projektna naloga: izdelava in predstavitev)</li> <li>- Pisni in ustni izpit</li> </ul>	<p style="text-align: center;">30%</p> <p style="text-align: center;">30%</p> <p style="text-align: center;">40%</p>	<ul style="list-style-type: none"> <li>- Portfolio with student's works (preparations on lectures, analysis of practical pedagogical work; practical pedagogical work, seminar work).</li> <li>- concluded laboratory work (preparing on exercise, report of laboratory exercises and defense, project work: execution and presentation)</li> <li>- Written and oral exam</li> </ul>
<p>Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.</p> <p>Pozitivno ocenjen portfolio in laboratorijske vaje z zagovorom so pogoj za pristop k pisnemu izpitu.</p> <p>Pozitivno ocenjen pisni izpit je pogoj za pristop k ustnemu izpitu.</p>		<p>Each of the mentioned commitments must be assessed with a passing grade.</p> <p>Positive grade of portfolio and laboratory work and advocacy are a prerequisite for access to the written exam.</p> <p>Positive grade of written exam is a prerequisite for access to the oral exam.</p>

**Reference nosilca / Lecturer's references:**

HAUKO, Robert, ANDREEVSKI, Damjan, PAUL, Domen, ŠTERK, Marko, REPNIK, Robert. Teaching of the harmonic oscillator damped by a constant force: The use of analogy and experiments. *American journal of physics : a publication of American association of physics teachers*, ISSN 0002-9505. [Print ed.], Sep. 2018, vol. 86, no. 9, str. 657-662, ilustr. <https://aapt.scitation.org/doi/pdf/10.1119/1.5044654>, doi: 10.1119/1.5044654.

REPNIK, Robert, SOVIČ, Magdalena. Didactical suitability of e-generated drill tests for physics. V: BILJANOVIĆ, Petar (ur.). Mipro proceedings, MIPRO 2016, 39th International Convention, May 30-June 3, 2016, Opatija, Croatia, (MIPRO ... (Tisak), ISSN 1847-3938). Rijeka: Croatian Society for Information and Communication Technology, Electronics and Microelectronics - MIPRO. cop. 2016, str. 962-965, ilustr. [http://docs.mipro-proceedings.com/proceedings/mipro\\_2016\\_proceedings.pdf](http://docs.mipro-proceedings.com/proceedings/mipro_2016_proceedings.pdf). [COBISS.SI-ID 22599432]

REPNIK, Robert, AMBROŽIČ, Milan. Practical school experiments with the centre of mass of bodies. *CEPS journal : Center for Educational Policy Studies Journal*, ISSN 1855-9719, 2018, vol. 8, no. 1, str. 97-116, ilustr. <https://ojs.cepsj.si/index.php/cepsj/article/view/311/270>, doi: 10.26529/cepsj.311. [COBISS.SI-ID11972169]