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REVIJA ZA ELEMENTARNO IZOBRAŽEVANJE
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POGLEDI RAZREDNIH UČITELJIC/UČITELJEV NA VZGOJNI VIDIK POUKA NA DALJAVO

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Izvleček/Abstract Raziskave o pouku na daljavo med epidemijo Covid-19 so usmerjene predvsem na njegov izobraževalni vidik; v pričujočem prispevku pa predstavljamo njegov vzgojni vidik. Izsledki v tem okviru opravljene raziskave kažejo, da je večina učiteljic/učiteljev razrednega pouka (n = 71) vzgojne dimenzije zasledovala predvsem nenačrtno. Prevladujeta skrb za medosebne odnose in disciplino, redkeje skrb za motivacijo in počutje učenk/učencev, mnogi se z vzgojo niso posebej ukvarjali. Večina jih ima negativno mnenje o možnostih vzgajanja na daljavo, mnogi verjamejo, da je to predvsem skrb staršev. Zato bi bilo ob ponovitvi pouka na daljavo treba razmisliti o načinih in smernicah vzpostavljanja vzgoje na daljavo.

Ključne besede:
vzgoja na daljavo, razredni učitelji/razredne učiteljice, pouk na daljavo, covid-19, razredni pouk

Primary School Teachers' Views on the Moral, Social, and Emotional Dimensions of Distance Learning

This paper focuses on the moral, social, and emotional dimensions of distance learning during COVID-19, as these dimensions have been neglected in most studies. The results of our study show that most primary school teachers (n=71) mostly pursued these dimensions unsystematically or not at all. They focused mainly on pupils' interpersonal relationships and discipline, less on their motivation and well-being. Most teachers expressed a negative opinion about the possibility for addressing these dimensions, many understanding this as the parents' duty. Therefore, if distance learning is reintroduced, it would be important to think about the possibilities and to create guidelines that include these dimensions.

Keywords:
distance learning, primary school teachers, COVID-19, primary education

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Uvod

Zaradi epidemije Covid-19 so se osnovne šole za določeno obdobje skoraj po vsem svetu zaprle, pouk pa je večinoma prešel na daljavo (The World Bank idr., 2021). O tem obdobju je bilo narejenih precej raziskav, ki so naslavljale predvsem vprašanja poteka pouka na daljavo, mnenja in doživljanja učiteljic/učiteljev in učenk/učencev, njihove veščine uporabe orodij za poučevanje in učenje na daljavo, kakšna je bila pri tem vloga staršev, kako je potekalo ocenjevanje, kakšno je bilo doseženo znanje ipd. (Ávalos idr., 2022; Bogatec idr., 2021; Feng idr., 2021; Kim, Dundas, idr., 2021; Klemenčič idr., 2021; Krajnc idr., 2020; Kruszewska idr., 2022; Moorhouse in Wong, 2022; Palau idr., 2021; Panadero idr., 2022; Phillips idr., 2021; Uršič in Puklek Levpušček, 2020; Winter idr., 2021). Raziskave so bile torej osredinjene predvsem na izobraževalni, ne pa tudi na vzgojni vidik pouka, čeprav je pouk načrten in sistematičen proces z vnaprej zastavljenimi izobraževalnimi in vzgojnimi cilji. Z drugimi besedami, pri pouku učenke/učenci pridobivajo znanje in razvijajo sposobnosti, hkrati pa razvijajo tudi celotno svojo osebnost, tj. čustva, interese, motivacijo, voljo, vrednote, stališča itd. (Blažič idr., 2003).

Nenazadnje pa tudi *Zakon o osnovni šoli* (2006) v svojem 2. členu določa tako vzgojne kot izobraževalne cilje.

Iz navedenih razlogov smo izvedli raziskavo, s katero smo želeli ugotoviti, ali se je, ko je pouk v Sloveniji potekal na daljavo, uresničeval tudi vzgojni vidik pouka. Ker je ta vidik toliko pomembnejši v obdobju srednjega in poznega otroštva, ko otroci pričenjajo vzpostavljati trdnejše vezi z vrstniki, oblikovati stabilnejšo osebnost ter razvijati večje (samo)zavedanje in samostojnost (Marjanovič Umek in Zupančič, 2020), smo raziskavo izvedli med učiteljicami/učitelji razrednega pouka.

Mesto vzgoje pri proučevanju pouka na daljavo

Kot kažejo raziskave, je bilo obdobje zaprtja šol za nekatere otroke problematično ne le z učnega vidika, temveč tudi z vidika njihovega socialnega, moralnega in čustvenega razvoja. Iz raziskave Klemenčič idr. (2021) razberemo, da se je veliko otrok soočalo s psiho-socialnimi obremenitvami.

Velik del se je sicer med prvim valom epidemije počutil varneje doma, kot se navadno v šoli, bili so veseli, da so bili doma, a kljub vsemu so se mnogi počutili bolj osamljene kot sicer, pogosteje kot običajno so občutili jezo, tudi spali niso tako dobro kot pred zaprtjem, bili so zaskrbljeni zaradi učenja in so se težko usmerili na šolsko delo, največ pa jih je pogrešalo stike s svojimi sošolkami/sošolci. Po mnenju anketiranih so imeli otroci težave z motivacijo za učenje, opravili so manj dela za šolo in bili manj zavzeti med učnimi urami kot pred zaprtjem šol. Zmanjšala se je tudi njihova prisotnost pri pouku. Tudi v raziskavi Kepic Mohar in Kovač (2021) se je pokazalo, da je med poukom na daljavo v prvem valu epidemije veliko anketiranih izgubilo stik z enim otrokom v razredu ali celo z več otroki. O težavah s pomanjkanjem osebnega stika z drugimi otroki in učiteljicami/učitelji, slabi komunikaciji z učiteljicami/učitelji, težavah z motiviranostjo, a tudi o večji samostojnosti otrok priča tudi raziskava Uršič in Puklek Levpušček (2020; o slednjem glej tudi Kepic Mohar in Kovač, 2021).

O negativnem vplivu, ki ga je pouk na daljavo imel na čustveno in psihofizično dobrobit otrok, je mogoče sklepati tudi iz podatkov o tem, kaj se je dogajalo z otroki po vrnitvi v šole (Klemenčič idr., 2021). Učiteljice/učitelji iz raziskave Klemenčič idr. (2021) ugotavljajo zadovoljstvo učenk/učencev z vrnitvijo v šolo; učenke/učenci pa navajajo predvsem zadovoljstvo ob ponovnem druženju z vrstniki. Skoraj polovica je bila tudi bolj motivirana za učenje kot prej. Obenem pa je mnogo učiteljic/učiteljev poročalo, da so otroci izražali več tesnobe kot pred zaprtjem šol, da so se težko skoncentrirali na pouk in da niso vzpostavili tako kakovostne interakcije s sošolkami/sošolci, kot so jo imeli pred tem. Zato velja pohvaliti, da je skoraj polovica šol ob ponovnem odprtju vpeljala dodatne ukrepe za socialno in čustveno podporo otrokom (Klemenčič idr., 2021), na nujnost katerih opozarja tudi poročilo, ki so ga pripravili The World Bank idr. (2021).

Tudi raziskave, osredinjene na razredni pouk, izpostavljajo manjšo motiviranost otrok za učenje, zgolj nekaj učiteljic/učitljev na razredni stopnji poroča o povečanju odgovornosti otrok. S stališči učiteljic/učitljev se ujemajo stališča staršev (Bogatec idr., 2021). Raziskava Kruszewska idr. (2022) je pokazala zmanjšano motiviranost otrok, manjšo učno učinkovitost, omejenost komunikacije med otroki in učiteljic/učitljev. Ker gre na razredni stopnji za zelo občutljiva leta, bi lahko vse to vplivalo na motnje pri razvoju učnih spretnosti v nadaljnjih fazah šolanja. Tudi obsežna raziskava Zavoda RS za šolstvo (Rupnik Vec idr., 2020), sicer primarno osredinjena na izobraževalni vidik pouka, je pokazala, da so na razredni stopnji zaznali številne stiske otrok (izstopata osamljenost in nedostopnost računalnika).

Četrto- in petošolci/petošolke izpostavljajo, da so izpostavili, da so pogrešali zlasti sodelovanje z drugimi otroki in razlago učiteljice/učitelja. Hkrati pa so zelo dobro ocenili sodelovanje z razredničarkami/razredniki, saj so imeli občutek, da jim je bilo mar zanje in da so se lahko kadar koli obrnili nanje.

Več raziskav je pokazalo, da sta učiteljice/učitelje med poukom na daljavo poleg učnega napredka skrbela tudi počutje otrok in njihova dobrobit (Ávalos idr., 2022; Kim, Leary, idr., 2021; Palau idr., 2021). Po drugi strani pa lahko iz raziskav razberemo, da je doseganje socialno-čustvenih ciljev pri poučevanju na daljavo ocenjeno kot težko. Tako med učiteljice/učitelje na razredni stopnji v Sloveniji prevladuje mnenje, da ti cilji s poukom na daljavo niso kompatibilni (Rupnik Vec idr., 2020). V raziskavi Kim, Dundas idr. (2021) so poročali o težavnosti tovrstnega dela zaradi pomanjkanja komunikacije z otroki in njihovimi starši, saj pogosto niso imeli informacij o tem, kaj se z otrokom na socialnem in čustvenem nivoju dogaja. Poleg tega niso mogli odreagirati na (ne)verbalne stiske otrok v realnem času in tako, kot bi sicer v razredu, bistveno pa je bila spremenjena tudi interakcija med učiteljice/učitelje in otrokom ter med otroki samimi. Raziskava Klemenčič idr. (2021) je pokazala, da so šole med zaprtjem nudili otrokom informacije o dobrem psihičnem počutju ter socialno in čustveno oporo, manj pa je znanega o načinih ter specifikah nudenja te podpore. Na pomen skrbi za otroke opozarjajo tudi Rio Poncela idr. (2021), ki izpostavljajo nujnost spodbujanja dialoga, občutljivosti do potreb otrok in vključevanja otrok v zanje pomembne dejavnosti, izvabljanja in poslušanja njihovih občutkov, vključevanja otrok v skrbne odnose, predanosti učenju in učnemu uspehu, širjenja upanja itd. Gre torej za skrb zlasti na čustveni, pedagoški in socialni ravni. Avtorji izpostavljajo, da sta bili skrb za otroke in podpora otrokom med zaprtjem šol za učiteljice/učitelje izčrpavajoči, tovrstno delo pa redko priznano, četudi ključno za celostni razvoj otrok. Enako izpostavljajo tudi raziskave o kompetencah učiteljice/učitelje za poučevanje na daljavo. Raziskava Mankki (2022) na primer kaže, da ravnateljice/ravnatelji osnovnih šol kot eno bistvenih značilnosti pouka na daljavo poleg ohranjanja rutine pri šolskem delu, nadzora nad delom otrok, natančnega načrtovanja pouka, izpostavljajo pomen spodbujanja povezanosti med učiteljice/učitelje in otroki. Po njihovem mnenju bi morale interakcije med učiteljice/učitelje in otroki biti tudi neformalne, saj to daje otrokom občutek varnosti. Na ta način lahko učiteljice/učitelje dobijo vpogled v to, kako se otrok uči, kakšno je njegovo počutje, kakšne so okoliščine doma, s tem pa se lažje prilagodi otrokovim potrebam.

Da bi to bilo mogoče, mora biti učiteljica/učitelj otroku dostopen med poukom in mu zagotavljati povratno informacijo. Pomembno pa je tudi omogočanje komunikacije med otroki samimi. Raziskava Kim idr. (2022) kaže, da je za bilo za učiteljice/učitelje v izrednih razmerah, kot je epidemija Covid-19, pomembno zlasti dvoje: skrb za dobro počutje otrok (empatičnost in komunikativnost, ekstravertnost) in zmožnost soočanja z negotovostjo (prilagodljivost, rezilientnost ali emotivna odpornost; ang. resilience) (tudi Moorhouse, 2021).

Raziskovalni problem in cilji

Četudi raziskave kažejo na pomembnost vzpostavljanja kakovostnega odnosa med otroki in učiteljicami/učitelji, skrbi za otroke in njihovo socialno in čustveno dobrobit, se zastavlja vprašanje, koliko so se učiteljice/učitelji tem in drugim, prvenstveno vzgojnim dimenzijam, dejansko posvečali med poukom na daljavo. Večina raziskav (izjema so Kim, Dundas, idr., 2021; Rio Poncela idr., 2021) se je namreč ukvarjala s stališči vključenih v vzgojno-izobraževalni proces, manj pa s tem, kaj konkretno se je v razredih dogajalo oz. kako, če sploh, so učiteljice/učitelji zmogli uresničevati svoje vzgojne naloge. Zato smo z raziskavo želeli ugotoviti, koliko pozornosti so učiteljice/učitelji zmogli posvečati vzgojnim dimenzijam pouka med šolanjem na daljavo v šolskem letu 2020/21 in kako so jih zmogli zasledovati. Zanimalo pa nas je tudi njihovo mnenje o možnostih vzgajanja na daljavo. Da bi odgovore lažje umestili v kontekst, nas je zanimalo tudi, kako so organizirali delo med poukom na daljavo.

Metoda

Vzorec in zbiranje podatkov

V raziskavi je bil uporabljen kvalitativni raziskovalni pristop. Slučajnostno izbran vzorec je zajemal 71 anketiranih (Ž = 68; M = 3) iz 62 javnih osnovnih šol (od tega 13 podružničnih) v Sloveniji. Povprečna delovna doba zaposlenih je bila 19,2 leta. V tabeli 1 je prikazano število anketiranih glede na razred poučevanja.

Tabela 1: Učiteljice/učitelji glede na razred poučevanja

Razred	Število učiteljic/učiteljev
1.	8
2.	22
3.	10
4.	16
5.	12
Kombinirani oddelek 1. in 2. razred	1
Kombinirani oddelek 3. in 4. razred	1
Kombinirani oddelek 2. in 4. razred	1
Skupaj	71

Z vsemi anketiranimi so bili opravljeni polstrukturirani intervjuji. Vprašanja so bila vezana na dve temeljni področji, in sicer na organizacijski vidik pouka na daljavo (primer vprašanja *Kako ste organizirali delo med poukom na daljavo*?) ter na stališča o vzgoji med poukom na daljavo (primer vprašanja *Je po vašem mnenju mogoče vzgajati na daljavo*?). Spraševalec si je sproti zapisoval odgovore vprašancev ali s soglasjem intervju z njimi posnel, kasneje pa posnetke prepisal.

Obdelava podatkov

Besedilo intervjujev smo analizirali z uporabo kvalitativne vsebinske analize, in sicer s programom QCAmap (Mayring in Fenzl, 2022). Uporabili smo tehniko induktivnega oblikovanja kategorij, to pomeni, da smo kategorije določali sproti, izhajajoči iz vsebine besedila.

Upoštevajoč vse zahtevane korake (Mayring, 2014), smo posamezne enote besedila (besede, besedne zveze ali povedi) vsakega intervjuja najprej označili in jim dodelili kode/kategorije glede na namen raziskave. Ko smo analizirali približno polovico vseh besedil, smo preverili skladnost kategorij z namenom raziskave in posamezne kategorije po potrebi združili ali spremenili. Že analizirano besedilo smo na tej osnovi vnovič analizirali in nadaljevali z analizo preostalega besedila. Ko smo zaključili z analizo, smo preverili ustreznost kategorij in posamezne kategorije združili oz. spremenili. Ko smo oblikovali končne kategorije, smo celotno besedilo še zadnjič analizirali.

Rezultati

Organizacijski vidik pouka

Način izvedbe pouka

Vseh enainsedemdeset anketiranih se je med poukom na daljavo z otroki srečevalo prek videokonferenčnih sistemov (najpogosteje Zoom ali MSTeams). Triinšestdeset anketiranih je poleg tega otrokom posredovalo različna gradiva za samostojno delo (npr. domače naloge; lastne video posnetke z razlago snovi in/ali navodili za delo; delovne liste; posnetke na Youtube za lažje razumevanje snovi; kvize; povezave do nalog, vaj ipd.). Gradiva so nalagali v šolsko spletno učilnico ali druge platforme (npr. MSTeams, spletna stran šole) ali jih pošiljali staršem po e-pošti. Ena učiteljica je gradivo vsaka dva tedna pošiljala tudi po navadni pošti.

Devet anketiranih je bilo otrokom vselej na voljo po telefonu, videokonferenčnem sistemu oz. elektronski pošti.

Pogostost srečanj in mnenje anketiranih o pogostosti srečanj

Skoraj tri četrtine anketiranih se je z otroki dobivalo vsaj trikrat tedensko, od tega dobra polovica vsak dan. Natančen pregled pogostosti srečanj je razviden iz tabele 2.

Tabela 2: Pogostost srečanj po videokonferenčnih sistemih

Pogostost srečanj	N	%
Vsak dan	37	52
3-krat na teden	11	15
1-krat na teden	7	10
2-krat na teden	4	6
3–4-krat na teden	4	6
1–2-krat na teden	3	4
2–3-krat na teden	3	4
3–5-krat na teden	1	1
Večkrat tedensko	1	1

Štiriintrideset anketiranih je povedalo tudi, kako dolgo so srečanja trajala. Od tistih, ki so se z otroki srečevali vsaj trikrat tedensko, so pri petnajstih srečanja trajala od dve uri do tri ure, pri enajstih pa pol ure do ure in pol.

Dva sta na daljavo delala po urniku. Po eden se je srečeval z otroki od ene ure do dveh ur, od treh do pet ur, od ene ure do treh ur. Od tistih anketiranih, ki so se z otroki srečevali enkrat do dvakrat tedensko, so pri štirih srečanja trajala po eno uro. Petinštiridesetim anketiranim se je število srečanj zdelo zadostno, samo za štiri pa teh srečanj ni bilo dovolj. Preostali se do tega niso opredelili. Anketirane smo prosili za obrazložitev odgovorov. Po mnenju enajstih otroci daljših srečanj pred ekrani ne bi zdržali, upadla bi jim pozornost oz. motivacija. Eden je izpostavil, da so načrtno želeli, da bi otroci preživeli čim manj časa pred zasloni. Za šest je srečanj bilo dovolj, saj so uspeli predelati vso učno snov. Dva od teh sta izrecno povedala, da je bilo samostojno delo otrok na osnovi navodil ter gradiv učiteljic/učiteljev produktivnejše oz. kakovostnejše. Samo za dva od anketiranih je bila količina srečanj zadostna (tudi) s socialnega vidika. Pri tem je eden od njiju povedal, da je z vidika obravnave snovi srečanj bilo nekoliko premalo. Za drugega pa je bilo srečanj dovolj, saj so bili tako učiteljice/učitelji, starši in otroci dovolj obremenjeni s samostojnim delom izven videokonferenčnih srečanj, zato večjih obremenitev ne bi prenesli.
Od štirih anketiranih, ki se jim je količina srečanj zdela nezadostna, so trije kot razlog izpostavili učni primanjkljaj – znanje otrok ni bilo zadostno, kakovostno, tudi sprotnega utrjevanja je bilo premalo.

Namen srečanj z otroki

V tabeli 3 so prikazane kategorije odgovorov anketiranih na vprašanje o tem, čemu so v glavnem namenjali srečanja.

Tabela 3: Namen srečanj z učenkami/učenci

Namen srečanj	N	%
Izobraževalni vidik pouka	61	85
Vzdrževanje stikov	26	37
Dopolnilni pouk in dodatna pomoč učenkam/učencem	20	28
Bralna značka	10	14
Posebni dogodki	5	7
Organizacija dela	2	3

Velika večina anketiranih je srečanja z otroki namenila izobraževalnim vidikom pouka (obravnavi nove snovi, ponavljanju, utrjevanju, dodatni razlagi snovi).

Pri tem jih je šest izpostavilo, da so poudarek dali predvsem ali izključno predmetom slovenski jezik, matematika, spoznavanje okolja. Štirje so poleg tega čas namenili pregledovanju nalog, ki so jih otroci doma opravljali samostojno.

Nekaj manj kot dve petini anketiranih je povedalo, da so skrbeli za vzdrževanje stikov med otroki. Enajst izmed njih je to počelo ob hkratnem sledenju izobraževalnim vidikom pouka. Samo pet jih je srečanja namenjalo v glavnem ali izključno vzdrževanju socialnih stikov. Dva sta temu namenjala čas včasih, dva pa predvsem v začetku prehoda na pouk na daljavo, kasneje pa so srečanja bila namenjena po večini izobraževalnim vidikom pouka. Štirje so eno srečanje na teden namenjali samo vzdrževanju stikov (vsi štirje so se z otroki srečevali vsaj trikrat tedensko). Ena učiteljica pa je eno takšno srečanje organizirala enkrat na dva tedna ali tri.

Dobra četrtina anketiranih se je z otroki srečevala tudi z namenom izvajanja dopolnilnega pouka oz. nudenja dodatne pomoči otrokom. Po navadi so ta dodatna srečanja potekala individualno z otroki, ki so pomoč potrebovali. Slaba šestina je posebna srečanja namenjala tudi bralni znački. Pet anketiranih je organiziralo posebna srečanja, kot so nastop za starše, kolesarski krožek, športni dan, praznovanja rojstnih dni in praznikov. Dva od anketiranih sta srečanja namenjala pogovoru o organizaciji dela, organizirala pa sta jih enkrat na teden – prav v ta namen.

Vzgoja med poukom na daljavo

Dimenzije vzgoje, ki so jih učiteljice/učitelji zasledovali

Od anketiranih smo pričakovali odgovore, katere dimenzije vzgoje so zasledovali med poukom na daljavo. Njihove odgovore smo razvrstili v pet kategorij, kot je razvidno iz tabele 4.

Tabela 4: Dimenzije vzgoje, ki so jih učiteljice/učitelji zasledovali

Dimenzija vzgoje	N	%
Medosebni odnosi oz. klima v razredu	37	52
Primerno vedenje oz. disciplina	34	48
Motivacija	14	20
Počutje učenk/učencev	7	10
Vzgoja na daljavo ni bila prisotna ali je bila prisotna le delno	17	24

Dobra polovica anketiranih je največ pozornosti namenjala medosebnim odnosom oz. klimi v razredu, in sicer jih je največ, tj. sedemnajst, posvečalo čas pogovorom z otroki med posebnimi urami ali v začetku oz. po koncu spletnega srečanja in med odmori med enim srečanjem in drugim. Štirinajst jih je otrokom omogočilo prost klepet oz. spletno druženje, npr. prek klepetalnic in v posebnih "zoom sobah", v katere se anketirani navadno niso vključevali. Sedem anketiranih si je vzelo čas tudi za družabne in druge igre z otroki. Nekateri pa so spodbujali druženje na najrazličnejše načine, npr. prek telefona, s petjem z balkonov ob isti uri, pošiljanjem voščilnic za praznike, s "zoom čajankami ", s pošiljanjem risbic po navadni pošti. Nekateri so več pozornosti namenjali pohvalam oz. spodbudam (3) in delu v manjših skupinah (3).

Skoraj polovica se jih je usmerila na skrb za disciplino oz. primerno vedenje. Največ, štiriindvajset, anketiranih je otroke skušalo naučiti predvsem spletnega bontona (npr. poslušanje drugih; izklop mikrofona, ko drugi govorijo; uporaba funkcij, kot so smeški, dvig roke; neuporaba klepeta; obvezen vklop kamere). Večina (24) se je disciplinskemu vidiku posvečala zaradi disciplinskih težav, ki so se pojavile predvsem v začetku prehoda na pouk na daljavo, npr. neupoštevanje spletnega bontona, prehranjevanje med poukom, igranje z igračami in s hišnimi ljubljenčki, izklapljanje kamere. Enajst pa se je tej dimenziji posvečalo, ker so želeli delo na daljavo čim bolj približati delu v šoli. Štirje so povedali, da je bilo disciplinskemu vidiku treba posvetiti pozornost, da je izobraževalno delo lažje steklo. Sedem se je kljub temu včasih moralo individualno pogovoriti s posamičnimi otroki ali starši, predvsem če so otroci ravnali v neskladju s spletnim bontonom ter zamujali na ure.

Petina anketiranih je povedala, da so pozornost namenjali motivaciji otrok. Sedem je kot razlog izpostavilo nemotiviranost otrok. To dimenzijo vzgoje so razvijali z različnimi metodami in oblikami poučevanja, s katerimi so naredili pouk bolj razgiban (4), ali pa so med poukom na daljavo eksplicitno spodbujali otroke k delu (2). Sedem se je z nemotiviranimi otroki pogovorilo tudi individualno, šest pa se jih je za pomoč obrnilo tudi na starše.

Desetina anketiranih se je posebej posvečala skrbi za počutje otrok, pri tem so trije izpostavili, da so se z otroki pogovarjali o njihovem počutju.

Četrtina anketiranih se z vzgojo med poukom na daljavo ni posebej ukvarjala ali se je z njo ukvarjala le delno. Pet se je posvečalo predvsem izobraževalnim ciljem in vzgojne cilje postavilo na stranski tir. Štirje so kot glavni razlog za to navedli pomanjkanje časa oz. nezadostno število srečanj.

Prav tako štirje so vzgojo uresničevali samo skozi dejavnosti, vezane na t. i. vzgojne predmete (šport, likovna umetnost, glasba), in skozi cilje, predpisane z učnim načrtom. Trije pa se z vzgojo niso ukvarjali, saj naj bi ta bila v domeni staršev.

Mnenje učiteljic/učiteljev o možnostih vzgajanja na daljavo

Na vprašanje, ali je mogoče vzgajati na daljavo, so odgovarjali različno. Kategorije odgovorov so razvidne v tabeli 5.

Tabela 5: Mnenje učiteljic/učiteljev o možnostih vzgajanja na daljavo

Mnenje učiteljic/učiteljev o možnostih vzgajanja na daljavo	N	%
Vzgoja na daljavo je težko ali le delno uresničljiva.	36	51
Vzgoja na daljavo ni mogoča.	14	20
Vzgoja na daljavo je mogoča, a ni kakovostna/učinkovita.	7	10
Vzgoja na daljavo je mogoča.	5	7

Polovica anketiranih je izrazila mnenje, da je vzgoja na daljavo težko ali le delno uresničljiva. Med razlogi jih je enajst omenjalo predvsem pomanjkanje osebnega stika z otroki, zaradi česar je onemogočeno razvijanje npr. strpnosti, solidarnosti, medsebojne pomoči, se povezati z učiteljico/učiteljem. Sedem je kot problem izpostavilo pomanjkanje vpogleda v dogajanje za kamero, v morebitne otrokove težave, družinske odnose, ali v potrebo otroka po pomoči učiteljice/učitelja ipd. Zanimivo je, da je za sedem anketiranih vzgoja na daljavo težko ali le delno uresničljiva zaradi hkratne prisotnosti staršev, ki vpliv učiteljice/učitelja zmanjša ali celo izniči. Poročali so, da so starši doseganje določenih vzgojnih učinkov (npr. odgovornost, samostojnost) oteževali tudi s tem, da so delo opravljali namesto otrok. Obenem pa je pet anketiranih izpostavilo, da je vzgoja med poukom na daljavo v glavnem preložena na starše. Šest jih je kot razlog za oteženo vzgojno delo na daljavo navedlo večjo pomembnost in s tem posvečanje primarnim izobraževalnim ciljem. Za osem anketiranih je bilo najtežje oz. nemogoče skrbeti za medosebne odnose in razredno klimo oz. za socialni razvoj otrok. Zanimivo je, da se je trem zdelo discipliniranje težko, prav tako trije pa so to izpostavili kot eno od tistih dimenzij, ki jih je mogoče uresničevati na daljavo.

Petina anketiranih je povedala, da vzgoja na daljavo ni mogoča. Devet je kot razlog navedlo pomanjkanje osebnih stikov med učiteljico/učiteljem in otroki ter med otroki samimi.

Pri tem so trije od teh anketiranih povedali, da se je poznala odsotnost konfliktnih situacij, potrebnih za razvijanje sposobnosti reševanja konfliktov. Dva od anketiranih sta kot razlog izpostavila prenos celotne vzgoje na starše. Ker so bili otroci v domačem okolju, jih učiteljica/učitelj naj ne bi mogel vzgajati. Vskakor pa ni bilo moč poseči v to okolje oz. zagotoviti, da bodo starši cilje dejansko dosegali. Po mnenju treh anketiranih ni bilo mogoče nadzirati otrok in s tem ne disciplinirati. Zanimivo pri tem je, da je eden od teh anketiranih povedal, da so bili tudi starši nemočni, drugi pa, da so lahko samo starši nekaj storili.
Za desetino anketiranih je vzgoja na daljavo sicer mogoča, a ni učinkovita oz. ni kakovostna, in sicer predvsem zaradi pomanjkanja osebnega stika med učiteljico/učiteljem in otroki ter med otroki samimi. Po mnenju treh anketiranih je neprimerljiva z vzgojo v živo.
Samo pet jih je povedalo, da je vzgoja na daljavo mogoča, če v to res verjamemo; če vanjo vložimo veliko dela in priprav ter kontinuitete; ker so pri njej prisotni tudi starši.

Razprava

Raziskava je pokazala, da se je večina razrednih učiteljic/učiteljev med zaprtjem šol z otroki po različnih platformah srečevala vsaj trikrat na teden. Kljub temu da so srečanja trajala različno dolgo, njihovo pogostost ocenjujemo kot pozitivno, saj to pomeni, da je večina otrok imela dokaj reden stik s svojimi učiteljicami/učitelji (in sošolkami/sošolci). Kot izpostavljajo Marjanovič Umek idr. (2021), so namreč za počutje mlajših otrok lahko pozitivna že srečanja na daljavo enkrat ali dvakrat na teden. Hkrati pa poudarjajo pomembnost srečanj predvsem za graditev pozitivnih medosebnih odnosov in tkanje prijateljstev. Zato lahko kot zaskrbljujoče izpostavimo, da je večina anketiranih, zajetih v našo raziskavo, zadostnost količine srečanj presojala predvsem glede na dosežene izobraževalne cilje/učinke.
Podobno ugotavljamo tudi na osnovi njihovih odgovorov na vprašanje o namenu srečanj. Velika večina anketiranih je namreč izpostavila, da so skrbeli v prvi vrsti za zasledovanje izobraževalnih vidikov pouka (obravnava nove snovi, ponavljanje, utrjevanje, dodatna razlaga snovi). Tudi večina tistih, ki so se posvečali vzdrževanju stikov med otroki, je bolj ali manj posredno povedala, da to vendarle ni bila njihova glavna skrb.

To je toliko bolj zaskrbljujoče, saj smo pri učiteljicah/učiteljih na razredni stopnji med prvim zaprtjem šol kot enega večjih problemov zaznali osamljenost otrok oz. pomanjkanje druženja in sodelovanja s sošolkami/sošolci (Rupnik Vec idr., 2020).

Pri anketiranih smo sicer prepoznali različne dimenzije vzgoje, ki so jih zasledovali na daljavo. Toda glede na njihove predhodne odgovore lahko sklepamo, da so tem dimenzijam posvečali pozornost po večini nenačrtno oz. glede na potrebe, ki so se pojavile med samimi srečanji. Konsistentno z odgovori o namenu srečanj je polovica povedala, da so skrbeli za medosebne odnose oz. razvijanje razredne klime. Spodbudno je, da so čas namenjali tudi pogovorom z otroki in jim omogočili, da so se na daljavo družili tudi le sami med seboj, kar je vsekakor omogočilo bolj sproščeno povezovanje. Z motivacijo otrok se je ukvarjalo dokaj malo anketiranih, sploh če upoštevamo, da je po raziskavah sodeč motivacija za delo otrokom med poukom na daljavo izrazito upadla (npr. Bogatec idr., 2021; Kruszewska idr., 2022). Ker sta socialna izolacija in občutek osamljenosti otrok med epidemijo močno vplivala na njihovo psihološko blagostanje, čustvene in vedenjske težave (Marjanovič Umek idr., 2021), je skrb vzbujajoč podatek, da se je le desetina anketiranih načrtno ukvarjala s skrbjo za počutje otrok.

Drugi vidik vzgoje, ki ga učiteljice/učitelji v največji meri izpostavljajo, je discipliniranje. A pri tem odgovori kažejo, da so se s tem večinoma ukvarjali zato, da bi otroci lažje sledili pouku oz. da bi izobraževalni vidik pouka lažje stekel. Vsekakor je disciplinskim težavam botrovalo tudi dejstvo, da so otroci zaradi šolanja v domačem okolju težje razumeli, da tudi srečanja na daljavo pomenijo pouk (Rupnik Vec idr., 2020). Četudi je discipliniranje eden od vidikov vzgoje in je disciplina v smislu zagotavljanja reda nujna za kakovosten pouk, discipline ne moremo razumeti samo s tega vidika. Odgovori anketiranih kažejo, da otroci v sam proces oblikovanja pravil ter skupnega dogovarjanja, navsezadnje tudi spreminjanja pravil, dejansko niso bili vključeni. Pa vendar bi to bilo nujno ne samo zato, ker bi jim omogočilo prevzemanje odgovornosti in osamosvajanje, marveč tudi zato, ker bi se s tem otroci pravil zelo verjetno v večji meri držali (Kroflič idr., 2011).

Najbolj zaskrbljujoč pa je podatek, da se četrtina anketiranih z vzgojo med poukom na daljavo ni posebej ukvarjala. V tem kontekstu nas ne preseneča, da ima velika večina anketiranih negativno mnenje o možnostih vzgajanja na daljavo.

Tovrstno mnenje so po lastnih besedah oblikovali predvsem na osnovi pomanjkanja osebnega stika z otroki, zaradi soprisotnosti staršev v vlogi vzgojiteljev ter pripisovanja večje pomembnosti doseganju izobraževalnih ciljev. Podobno kažejo rezultati raziskave Rupnik Vec idr. (2020), v kateri učiteljice/učitelji na razredni stopnji po večini izražajo stališče, da socialno-čustvenih ciljev ni mogoče uresničevati med poukom na daljavo. Izhajajoč iz omenjene raziskave, se tudi mi sprašujemo, v kolikšni meri se tej dimenziji oz. v našem primeru načrtni vzgoji učiteljice/učitelji dejansko posvečajo v običajnih razmerah.

Sklep

Osnovne šole kot vzgojno-izobraževalne inštitucije morajo poskrbeti za otrokov celostni razvoj, torej ne le za njegovo izobrazbo, temveč tudi za oblikovanje njegovih vrednot, stališč, navad in interesov, čustev, odnosa do sebe in drugih itd. Izobraževanje in vzgoja se tako pri pouku neizbežno prepletata. Ne nazadnje na to kaže tudi dejstvo, da zakonodaja zavezuje osnovne šole k sledenju ne le učnim načrtom, v katerih so sicer poleg izobraževalnih zapisani tudi vzgojni cilji, temveč tudi lastnemu vzgojnemu načrtu. Žal pa se še vedno dogaja, da šole primarno razumemo kot izobraževalne ustanove, v katerih je vzgojni vidik zapostavljen oz. manj pomemben. To se je toliko bolj pokazalo v obdobju šolanja na daljavo. Ministrstvo za izobraževanje, znanost in šport ter Zavod RS za šolstvo sta pripravila priporočila za delo na daljavo (Kustec idr., 2021), v katerih pa je vzgoja omenjena zgolj v besedni zvezi » in izobraževanje«, posebej pa le v delu, ki se ukvarja z dijaškimi domovi. Še več. Priporočila vežejo pouk na uresničevanje učnih ciljev, učnih vsebin in standardov znanja, torej zgolj na izobraževalni vidik. Tudi številne raziskave o pouku na daljavo, kot smo že pokazali, vprašanja uresničevanja in uresničljivosti vzgoje na daljavo niso sistematično in neposredno naslovile.

Podatki raziskav o vplivih šolanja na daljavo na otroke so zaskrbljujoči. Veliko ali celo večina težav otrok v tem obdobju je bila vezana na področja, ki so primarno stvar vzgoje, toda ta je bila, kot smo ugotovili v naši raziskavi, postavljena na stranski tir. Mnogi v našo raziskavo vključeni so izpostavili, da je vzgoja na daljavo težka ali le delno uresničljiva, nekateri celo, da ni mogoča in da je v glavnem v domeni staršev.

Po mnenju nekaterih anketiranih so starši med poukom na daljavo pretirano posegali v delo otrok in s tem dejansko preprečevali doseganje zelo pomembnih vzgojnih ciljev razvijanja otrokove samostojnosti in odgovornosti (glej tudi Rupnik Vec idr., 2020). Vsekakor se je meja med šolo in domom med epidemijo zabrisala. A četudi so bili otroci doma, to še ne legitimira popolnega prenosa vzgojne funkcije šole na starše. Slednji namreč vzgajajo po drugačnih načelih, »po občutku«, medtem ko je vzgoja šole načrtna dejavnost, usmerjena v specifične cilje. Ob tem naj izpostavimo le enega izmed takih ciljev, ki ga v naši raziskavi nihče od vključenih ni omenil in ki ga tudi v splošnem diskurzu nismo zaznali v zadostni meri. Kritično razmišljanje. Vprašamo se lahko, ali smo izgubili priložnost, da bi se z otroki pogovorili o vsem tistem, kar se je med epidemijo v družbi dogajalo. Od pojava različnih t. i. teorij zarote, do številnih kontradiktornih informacij in legitimiranja represivnih obrazcev »preventivne oblasti« (Kroflič, 2020). Naivno bi bilo verjeti, da otroci tem dejavnikom niso bili podvrženi. Realno pa je verjeti, da je, ker je vzgoja bila prepuščena domala v celoti družinskemu okolju, mnogim otrokom bila odvzeta možnost soočenja z različnimi perspektivami in s tem tudi možnost razvoja kritičnega pogleda na svet in dogajanje okoli njih.

Strinjamo se, da je osebna bližina za vzpostavitev kakovostnega, pristnega odnosa, ki je v temelju vzgojnega delovanja (Kroflič, 2008; Todd, 2003), pri vzgojni vlogi šole izjemno pomembna in da pouk na daljavo po svoji kakovosti in učinkovitosti, predvsem ko gre za vzgojo, ni primerljiv s poukom v živo (glej tudi Marjanovič Umek idr., 2021; Medveš, 2020). Pa vendar, kot navaja Medveš (2020), odnosi, ki se vzpostavljajo med poukom na daljavo »[…] sicer niso telesni, a imajo vse razsežnosti socialnega«. Zato moramo pedagoginje/pedagogi, ko osebne bližine ni mogoče vzpostaviti iz objektivnih razlogov, kakršen je bil tudi šolanje na daljavo, razmisliti o novih načinih njenega vzpostavljanja, na nacionalni ravni pa bi morali v primeru ponovitve pouka na daljavo temeljito razmisliti tudi o možnostih oblikovanja smernic za delo učiteljic/učiteljev, v katere bi bila vključena tudi vzgojna dimenzija pouka.

Summary

The main task of teachers is to educate pupils by, on the one hand, helping them acquire and master knowledge and develop psychomotor skills, and, on the other hand, shaping their whole personality (not only the cognitive, but also the moral, social and emotional dimensions) in accordance with certain values.

The first process is referred to in Slovenian as *izobraževanje*, the second as *vzgoja* (for details, see Lesar and Peček, 2009). However, during the closure of schools in response to the COVID-19 pandemic, practitioners as well as researchers focused mainly on the first process, while the second was left behind, if not completely ignored. The same was true for policy makers, whose guidelines focused almost exclusively on education as *izobraževanje*. This was the main reason that led us to conduct a qualitative study to establish whether and to what extent teachers paid attention to *vzgoja* in distance learning in the school year 2020/21. We also wanted to study their opinions about opportunities for education in the sense of *vzgoja* during distance learning. To better contextualize their answers, we were also interested in the organization of their work during distance learning. Since *vzgoja* is even more important in primary education, our study included primary school teachers (n=71, 95.77% women) from 62 public schools in Slovenia. We conducted semi-structured interviews and analysed their responses with QCAmap (Mayring and Fenzl, 2022), using qualitative content analysis, more specifically inductive category formation (Mayring, 2014). Our study showed that most teachers combined online meetings with pupils (mainly via Zoom or MSTeams) with provision of materials online (e.g., via e-mail, Moodle). Most teachers met with pupils at least three times a week, but mainly to pursue goals related to *izobraževanje* (teaching new topics, revising a topic, consolidating knowledge, providing additional explanation of topics). When asked directly about which dimensions of *vzgoja* they pursued, their answers showed that most of them did not pay systematic attention to these dimensions and did so mainly in terms of needs that arose in real time. Most teachers mentioned maintaining pupils' interpersonal relationships or developing a classroom climate. The second most frequently tracked dimension was disciplining pupils (e.g., teaching online meeting etiquette). Worryingly, only a very small proportion of teachers cared about fostering pupils' motivation, and even fewer teachers systematically cared about pupils' well-being.

The most worrisome finding is that a quarter of teachers paid no special attention to *vzgoja* at all, and that more than three-quarters of teachers have a negative opinion about the capacity of education as *vzgoja* during distance learning, mainly because of the lack of personal contact with and between pupils, but also because of the simultaneous presence of parents, who took over this part of education, as well as the belief that educational goals in terms of *izobraževanje* are more important.

Even though we believe that personal contact is crucial for building quality and genuine relationships that are the basis for *vzgoja*, physical absence does not mean that such contacts cannot be established in another, still social way. For these reasons, pedagogues need to think about how close personal relationships can be built even under conditions of distance learning, and policy makers should develop guidelines for distance learning that would encompass education both as *izobraževanje* (acquisition of knowledge and skills) and as *vzgoja* (development of the whole personality, i.e., emotions, interests, motivation, will, values, etc.).

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KOGNITIVNA UČINKOVITOST SLOVENSKIH, INDIJSKIH IN GAMBIJSKIH NADARJENIH UČENCEV PRI REŠEVANJU MISELNIH NALOG

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Izvleček /Abstract

V prispevku prikažemo primerjalno analizo med evidentiranimi nadarjenimi slovenskimi, gambijskimi in indijskimi učenci, kjer smo poskušali ugotoviti, kako so se odrezali pri reševanju izbranih miselnih nalog, kjer smo bili osredotočeni na logično-matematično in prostorsko inteligentnost. Ugotovili smo, da se rezultati testiranih skupin med seboj pričakovano razlikujejo. Slovenski učenci so se od desetih sklopov nalog bolje kot njihovi indijski in gambijski vrstniki skupno odrezali kar pri sedmih sklopih nalog, pri štirih nalogah smo zaznali statistično značilno razliko med slovenskimi in indijskimi otroki, primerjava med slovenskimi in gambijskimi učenci pa pokaže, da je pri vseh sklopih miselnih nalog imela boljše rezultate skupina otrok iz Zahodnega sveta z visokim HDI (*Indeksom človekovega razvoja*).

Ključne besede:
inteligentnost, nadarjenost, nadarjene učenke/nadarjeni učenci, miselne naloge, kulturno okolje, šolstvo v Indiji, šolstvo Gambiji.

Cognitive Efficiency of Slovenian, Indian and Gambian Gifted Students in Performing Mental Tasks

In this paper, we present a comparative analysis between registered gifted Slovenian, Gambian, and Indian students in which we sought to find out how they perform in solving selected mental tasks, where we were focused on logical-mathematical and spatial intelligence as a function of the social environment from which the students came. We found that the results for the test groups differed. Out of ten task sets, Slovenian students performed better than their Indian and Gambian peers in as many as seven task sets; in four tasks we found a statistically significant difference between Slovenian and Indian children, and a comparison between Slovenian and Gambian students shows that Slovenian children scored better on mental task sets in all groups.

Keywords:
intelligence, giftedness, gifted students, mental tasks, cultural environment, education in India, education in Gambia.

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Inteligentnost in nadarjenost

Številni avtorji (Bucik et al., 2013; Musek in Pečjak, 1997; Pogačnik, 1995 et al.) inteligentnost opredeljujejo kot sposobnost hitrega in učinkovitega procesiranja informacij na način, ki je za posameznika nov, medtem ko nekateri drugi le-to opredeljujejo kot miselno sposobnost za prepoznavanje in reševanje problemskih situacij, kot je sposobnost učenja iz izkušenj ter razumevanja in obravnave abstraktnih konceptov (Cherry, 2018; DiLalla, 2000; Marentič Požarnik, 2000; Nisbett et al., 2012; Sternberg, 2018). Inteligentnost je torej sposobnost pravilnega presojanja, razumevanja in sklepanja, sposobnost tvorjenja konceptov in razumevanja njihovega pomena, ustreznega reševanja problemov ali sposobnost racionalnega razmišljanja. Je veščina, sposobnost ali spretnost reševanja problemov ali oblikovanja idej in izdelkov, ki imajo določeno vrednost znotraj enega ali več različnih kulturnih okolij (Gardner, 1995). Lahko jo opredelimo kot splošno sposobnost živih bitij, da obdelujejo informacije na način, ki je zanje nov, torej razmeroma neodvisen od izkušenj; ta splošna kognitivna sposobnost pa se lahko izraža v vrsti bolj specifičnih inteligentnosti (Spearman, 1927).

Inteligentnost lahko najširše opredelimo kot zmožnost za učinkovito mišljenje in učenje iz izkušenj ter kot sposobnost prilagajati se okolju (Bucik et al., 2013; Kompare et al., 2001; Marentič Požarnik, 2000). Gardner (1995) navaja nekatere samostojne inteligentnosti: (i) jezikovna inteligentnost; (ii) logično-matematična inteligentnost; (iii) prostorska inteligentnost; (iv) glasbena inteligentnost; (v) telesno-gibalna inteligentnost; (vi) naturalistična inteligentnost; (vii) avtorefleksivna (intrapersonalna, osebna) inteligentnost; (viii) medosebna (interpersonalna). Gardner (1995) inteligentnost opredeljuje kot niz spretnosti, ki so potrebne za reševanje problemov oz. potencial za odkrivanje in ustvarjanje problemov, ki so temelj pridobivanja novega znanja, zmožnost ustvarjanja uporabnih izdelkov in učenja iz preteklih izkušenj.

Od vsega začetka znanstvenega ukvarjanja z inteligentnostjo in vse do danes imajo psihologi na konstrukt »inteligentnost« zelo različne poglede (Bucik, 1997; Bucik et al. , 2013; Pogačnik, 1995). Takšno razlikovanje inteligentnosti sta v svoji teoriji predstavila Cattell in Horn (1978), ki temelji na osnovnem razlikovanju med inteligentnostjo, ki je podedovana in temelji na biološki zmogljivosti procesiranja informacij ter inteligentnostjo, ki jo ljudje pridobimo tekom razvoja iz šolskega in družbenega okolja.

Kristalizirana inteligentnost je povezana s sposobnostjo rabe že naučenega znanja, fluidna inteligentnost pa s sposobnostjo učenja in iznajdljivosti v novih situacijah (Cattell in Horn, 1978; Marjanovič Umek in Zupančič, 2004). Fluidna inteligentnost izhaja iz centralnega živčnega sistema (Pogačnik, 1995) in odraža kapacitete procesiranja informacij (Repovš, 2007). Kristalizirana inteligentnost pa je odraz znanj in izkušenj, ki smo jih pridobili v času izobraževanja (Repovš, 2007). Naj torej v kontekstu opredelitve inteligentnosti izpostavimo tudi nadarjenost oz. nadarjene učence, kot posameznike, ki so na posameznem področju kognitivne učinkovitosti ali v splošni inteligentnosti pokazali nadpovprečni dosežke. Nadarjenost je torej del inteligentnosti (gre za t.im. izjemno visoko inteligentnost) in obratno, inteligentnost je del nadarjenosti (Koncept, 2019, str. 21).

Inteligentnost in okolje

Ljudje se ne razlikujemo le po stopnji inteligentnosti, pač pa tudi v tem, na katerih področjih smo miselno učinkovitejši. Pojem inteligentnosti je torej zelo zapleten, saj se poleg miselnih, kognitivnih in drugih lastnosti človekove osebnosti, vanj vpletajo tudi mnogi družbeni, vzgojni, izobrazbeni, kulturni in drugi dejavniki (Bucik et al., 2013; Conklin et al., 2007; Der, Batty, Deary, 2006; Kompare et al., 2001; More, Shivkumar, Gangane, Shende, 2013; Pogačnik, 1995). Musek (1997) opredeli kot dejavnike vplivanja in izvora inteligentnosti predvsem dedovanje, okolje, samodejavnost, genetske vplive, biološke vplive in sociokulturne vplive. Inteligentnost je torej posledica izredno zapletenih duševnih procesov, ki potekajo v centralnem živčnem sistemu, še posebej v velikih možganih. Razvoj in izražanje le-te sta neločljivo povezana s tremi pomembnimi dejavniki delovanja človeka: s kognitivnimi zmogljivostmi, z naučenimi sposobnostmi in navadami ter z ustrezno motiviranostjo, kar pomeni usklajeno delovanje dednih dispozicij, vplivov okolja in lastne aktivnosti (Bucik et al., 2013). Razlike v inteligentnosti med skupinami so odvisne predvsem od (kulturnega) okolja, v katerem le-te živijo in od dednosti ter interakcije med obema (Kompare et al., 2001). Večina študij ocenjuje, da je heritabilnost kvocienta inteligentnosti (IQ) nekje med 0,30 in 0,75 (Galton, 2012). To kaže, da ima genetika večjo vlogo kot okolje pri ustvarjanju razlik v IQ med posamezniki. Študije o vplivu interakcije gen-okolje na inteligentnost so pokazale, da se genetske in skupne okoljske komponente spreminjajo v nasprotnih smereh kot funkcija socialno-ekonomskega statusa (SES), tj. heritabilnost IQ je pri nizkih posameznikih SES zelo nizka in obratno.

Najverjetnejša razlaga za to je lahko, da otroci, ki živijo v revščini, ne morejo razviti svojega polnega genetskega potenciala. Poleg ožjega, družinskega okolja je še posebej pomembno širše družbeno okolje, saj tu posamezniki pridobijo najpomembnejše izkušnje in številne ustrezne dražljaje, ki lahko prispevajo k hitrejšemu in bolj bogatemu razvoju inteligentnosti (Bucik et al., 2013). Vplive okolja na razvoj inteligentnosti lahko grobo razvrstimo v naslednje skupine (Pogačnik, 1995): (i) naključni dejavniki (bolezni, poškodbe, odtujitev od družine); (ii) struktura družine (vrstni red rojstev, časovna razlika med sorojenci); (iii) odnos staršev (različno obravnavanje); (iv) interakcija z vrstniki (neidentificiranje z vrstniki, različno obravnavanje); (v) izvendružinski vplivi (sorodniki, vrstniki, učitelji in drugi). Zaradi pomanjkanja podatkov o dejavnikih, ki vplivajo na IQ pri indijskih otrocih, predstavljamo rezultate multicentrične raziskave, s katero so določili okoljske dejavnike, ki vplivajo na IQ pri indijskih otrocih (Makharia et al., 2016). Avtorji (ibid.) so v študiji ugotovili, da so okoljski dejavniki (kot npr. kraj bivanja, telesna dejavnost, družinski dohodek, izobrazba staršev), vplivali na IQ otrok. Zato mora biti otroku zagotovljeno optimalno okolje, da lahko razvije svoj poln genetski potencial (Makharia et al., 2016).Med družbenimi dejavniki, ki vplivajo na inteligentnost, ima velik pomen in vlogo ravno šolsko okolje. Presenetljivo je, da nanjo igra pomembno vlogo tudi kakovost poučevanja v vrtcu in v prvem razredu osnovne šole. Še posebej je to pomembno, ko govorimo o nadarjenih otrocih oz. učencih in spodbudnem učnem okolju, ki bi pomembo vplivalo na zadovoljitev njihovih intelektualnih in drugih potreb.

Raziskovalni problem, namen in cilji

Na podlagi zastavljenega problema smo si zastavili naslednja cilja: (1) ugotoviti, kako uspešni bodo nominirani nadarjeni slovenski, indijski in gambijski učenci pri posameznih miselnih nalogah; (2) ugotoviti, pri katerih vrstah miselnih nalog se bodo nominirani nadarjeni slovenski, indijski in gambijski učenci najbolje oz. najslabše odrezali.

Raziskovalne metode in vzorec

Pri raziskovanju smo uporabili deskriptivno metodo in kavzalno neeksperimentalno metodo pedagoškega raziskovanja. V prvi raziskovalni vzorec je bilo vključenih 26 nominiranih (evidentiranih) nadarjenih učencev iz izbranih slovenskih OŠ gorenjske

regije in 26 učencev vrstnikov indijske osnovne šole, kjer je večina vključena v Rockwell International School, Hyderabad; v drugi vzorec, ki smo ga opravili leto dni kasneje, pa 20 nominiranih nadarjenih učencev goriške regije ter 20 učencev gambijske osnovne šole (African Children School, Brusubi), skupno *92 osemletnih učencev* (27 slovenskih deklic in 19 slovenskih dečkov ter 12 indijskih deklic in 14 indijskih dečkov ter 16 gambijskih dečkov in 4 deklice).

Pripomočki

Uporabili smo spletni test miselnih nalog (izbrane naloge iz Bucik, Bucik, in Bucik 2013), ki so ga rešili evidentirani nadarjeni slovenski, gambijski in indijski učenci na izbranih šolah. Test je vseboval 10 sklopov po 3-5 nalog zaprtega tipa. Objektivnost smo zagotovili z enakimi navodili reševanja testa za vse učence in z zaprtimi tipi vprašanj, zanesljivost pa z enopomenskimi, jasnimi in natančnimi navodili ter vprašanji v njim razumljivem jeziku.

Postopek zbiranja in obdelave podatkov

Podatke smo zbirali s pomočjo spletnega testa, ki smo ga poslali na izbrane osnovne šole ter osebno (v vseh treh državah). Sodelujoči evidentirani oz. nominirani nadarjeni učenci so teste izpolnjevali individualno in s soglasjem staršev; rešitve so bile uporabljene zgolj v raziskovalne namene. Čas, ki so ga imeli na razpolago je bil 60 min. Pridobljene rezultate testa smo obdelali s pomočjo statističnega programa SPSS, povezanost med obravnavanimi spremenljivkami smo preverili s Pearsonovim χ^2 preizkusom. Kjer je bilo več kot 20 % pričakovanih frekvenc v kontingenčni tabeli nižjih od vrednosti 5 in bi lahko bili rezultati hi-kvadrat testa nezanesljivi, je bil uporabljen in navajan rezultat Likelihood Ratio testa. Zaradi majhnega vzorca smo za testiranje razlik v povprečnih vrednostih med dvema skupinama uporabili tudi Mann-Whitney U test. V indijski šoli Rockwell International School smo delo z nadarjenimi in drugimi učenci opazovali v obdobju enega meseca, v Gambiji pa v obdobju dveh mesecev.

Rezultati in razprava

Ponovno poudarjamo, da obstaja pomembna razlika med testi inteligentnosti in zbirkami miselnih nalog. Merjenje inteligentnosti je končna faza natančno izdelanega načrta, pri katerem si zastavimo vprašanja, na katera moramo tudi odgovoriti (Bucik, 1997): koga bomo testirali; katere vrste mentalnih sposobnosti bi radi raziskali; kakšen je cilj naše; kakšna znanja in izkušnje imamo kot testatorji. Inteligenčni kvocient je pojem, ki predpostavlja, da je človekova inteligentnost izmerjena na reprezentativen način (Pogačnik, 1995).

Omenjen način merjenja inteligentnosti lahko uporabljamo pri merjenju inteligentnosti otrok, ki so v letih, ko se le-ta enakomerno, linearno razvija (Pogačnik, 1995). Računamo torej razvojni količnik inteligentnosti, ki je razmerje med mentalno dejansko starostjo (Bucik et al., 2013). Inteligentnost se pri ljudeh (tako kot večina pojavov v naravi) porazdeljuje v obliki normalne, Gaussove (zvonaste) porazdelitve (Bucik et al., 2013; Jurman, 2004; Kompare et al., 2001; Pogačnik, 1995; Sternberg, 2018). Binetov test (Binet in Simon, 1916) temelji na tristopenjskem hierarhičnem modelu inteligentnosti, Wechslerjev test inteligentnosti pa sloni na odnosu med rezultatom testa in pričakovanim povprečjem za posamezni starostni razred ter pokriva širok spekter mentalnih sposobnosti na celotnem starostnem razponu, kjer meri splošno intelektualno zmogljivost in tudi ločeno verbalno in neverbalno inteligentnost (Sattler, 2008; Wechsler, 2003). Pravi testi so torej standardizirani in natančno umerjeni, zato so dobri merski instrumenti. Za posamezno starost testiranca imajo vse naloge natančno določeno težavnost, veljavnost, občutljivost in zanesljivost. Pri miselnih nalogah pa so vrednosti v težavnosti približne in premalo standardizirane za natančno izračunavanje standardnih ocen inteligentnosti (Bucik et al., 2013). *Namen teh nalog ni izmeriti in izračunati IQ učencev, pač pa med seboj primerjati dve ali več skupin testirancev iste starosti, ki so izpostavljeni popolnoma drugačnemu družbenemu/ kulturnemu okolju.* V raziskavi smo ugotavljali uspešnost reševanja miselnih nalog s področja natančnega vidnega zaznavanja, pravil in zakonitosti, vzpostavljanja odnosov, sklepanja o celoti in prostorske predstavljivosti s strani evidentiranih nadarjenih slovenskih, gambijskih in indijskih učencev. V vseh nalogah se prepletajo elementi vidnega zaznavanja in natančnega opazovanja ter logičnega mišljena; v nadaljevanju smo le-te zaradi boljše preglednosti razvrstili v omenjenih pet področnih skupin.

Ugotavljamo, da je razlika med skupinama slovenskih in indijskih učencev je statistično značilna ($p < 0,05$) pri nalogah dve enaki ($p = 0,034$), sudoku ($p = 0,027$) in mreža vzorcev ($p = 0,022$), prav tako pa statistično značilno razliko zaznamo pri končnem skupnem rezultatu testa ($p=0,024$), statistično značilno boljši rezultat so dosegli slovenski otroci.

Tabela 1: Uspešnost slovenskih (1. skupina) in indijskih učencev pri vseh sklopih nalog

	slovenski učenci 1 (N=26) $\bar{x}$	indijski učenci (N=26) $\bar{x}$	MW U test testna statistika	p
Dve enaki*	3,23	2,65	228,000	0,034
Vsiljivci	2,12	1,50	262,000	0,153
Nizi	2,88	3,08	319,000	0,706
Analogije	0,81	1,54	241,000	0,061
Matrike	2,08	1,65	262,500	0,140
Sudoku*	8,50	6,58	217,500	0,027
Mreža vzorca*	3,23	2,65	218,500	0,022
Polnjenje likov	1,73	1,65	328,000	0,845
Štetje kock	2,88	2,08	247,000	0,091
Plašči in telesa	1,04	1,38	272,000	0,201
Skupne točke vseh nalog*	28,50	24,77	215,000	0,024

*Razlika med skupinama je statistično značilna ($p < 0,05$)

Tabela 2: Uspešnost slovenskih (2. skupina) in indijskih učencev pri vseh sklopih nalog

slovenski učenci 2 (N=20) indijski učenci (N=26)	slovenski učenci 2 (N=20) $\bar{x}$	indijski učenci (N=26) $\bar{x}$	MW U test testna statistika	p
Dve enaki*	3,45	2,65	143,000	0,006
Vsiljivci*	3,35	1,50	90,000	< 0,001
Nizi*	3,70	3,08	179,000	0,031
Analogije	1,40	1,54	256,000	0,927
Matrike	2,30	1,65	193,500	0,128
Sudoku*	15,80	6,58	5,000	< 0,001
Mreža vzorca*	4,40	2,65	35,000	< 0,001
Polnjenje likov*	2,55	1,65	87,500	< 0,001
Štetje kock	3,05	2,08	224,500	0,415
Plašči in telesa*	2,40	1,38	118,000	0,001
Skupne točke vseh nalog*	42,45	24,77	23,500	< 0,001

*Razlika med skupinama je statistično značilna ($p < 0,05$).

Razlika med drugo skupino slovenskih učencev in indijskih ($p = 0,006$), vsiljivci ($p < 0,001$), nizi ($p = 0,031$), sudoku ($p < 0,001$), mreža vzorcev ($p < 0,001$), polnjenje likov ($p < 0,001$) in plašči in telesa ($p = 0,001$), pri vseh naloga so boljši rezultat v povprečju dosegli slovenski učenci, še posebej izstopajo pri nalogi sudoku, ki razvija pozornost, logično in strateško mišljenje. Statistično značilno razliko zaznamo pri končnem skupnem rezultatu testa ($p < 0,001$), boljši rezultat so dosegli slovenski otroci.

Tabela 3: Uspešnost slovenskih (2. skupina) in gambijskih učencev pri vseh sklopih nalog

slovenski učenci 2 (N=20) gambijski učenci (N=20)	slovenski učenci 2 (N=20)	Gambijski učenci (N=20)	MW U test	
	$\bar{x}$	$\bar{x}$	testna statistika	p
Dve enaki*	3,45	2,50	87,500	0,001
Vsiljivci*	3,35	0,40	8,500	< 0,001
Nizi*	3,70	0,70	16,000	< 0,001
Analogije*	1,40	0,55	104,000	0,006
Matrike*	2,30	1,10	105,500	0,008
Sudoku*	15,80	6,40	14,500	< 0,001
Mreža vzorca*	4,40	2,00	52,0500	< 0,001
Polnjenje likov*	2,55	0,95	42,500	< 0,001
Štetje kock*	3,05	0,10	85,000	< 0,001
Plašči in telesa*	2,40	1,05	63,000	< 0,001
Skupne točke vseh nalog*	41,60	15,75	0,000	< 0,001

*Razlika med skupinama je statistično značilna ($p < 0,05$).

Ugotavljamo (Tabela 3) , da je razlika med skupinama statistično značilna ($p < 0,05$) tako pri vseh posameznih nalogah, ki so jih reševali slovenski učenci druge skupine in gambijski učenci, kot tudi pri skupnem rezultatu testa ($p < 0,001$), zato lahko potrdimo, da med skupinama obstaja razlika pri reševanju kompleksnejših nalog. Ker je vzorec otrok neprezentativen, rezultatov ne moremo posploševati na celotno populacijo.

Razlika (Tabela 4) med skupinama je statistično značilna ($p < 0,05$) pri vseh nalogah, ki so jih reševali slovenski učenci prve skupine in gambijski učenci, razen pri sklopu analogije, sudoku ter plašči in telesa.

Tabela 4: Uspešnost slovenskih (1. skupina) in gambijskih učencev pri vseh sklopih nalog

slovenski učenci 1 (N=26) gambijski učenci (N=20)	slovenski učenci 1 (N=26)	gambijski učenci (N=20)	MW U test	
	$\bar{x}$	$\bar{x}$	testna statistika	p
Dve enaki*	3,23	2,50	149,500	0,009
Vsiljivci*	2,12	0,40	93,000	< 0,001
Nizi*	2,88	0,70	74,500	< 0,001
Analogije	0,81	0,55	230,000	0,453
Matrike*	2,08	1,10	136,500	0,005
Sudoku	8,50	6,40	209,500	0,261
Mreža vzorca*	3,23	2,05	165,500	0,029
Polnjenje likov*	1,73	0,90	144,500	0,008
Štetje kock*	2,88	0,10	47,500	< 0,001
Plašči in telesa	1,04	1,05	254,500	0,897
Skupne točke vseh nalog*	28,50	15,75	39,000	< 0,001

*Razlika med skupinama je statistično značilna ($p < 0,05$).

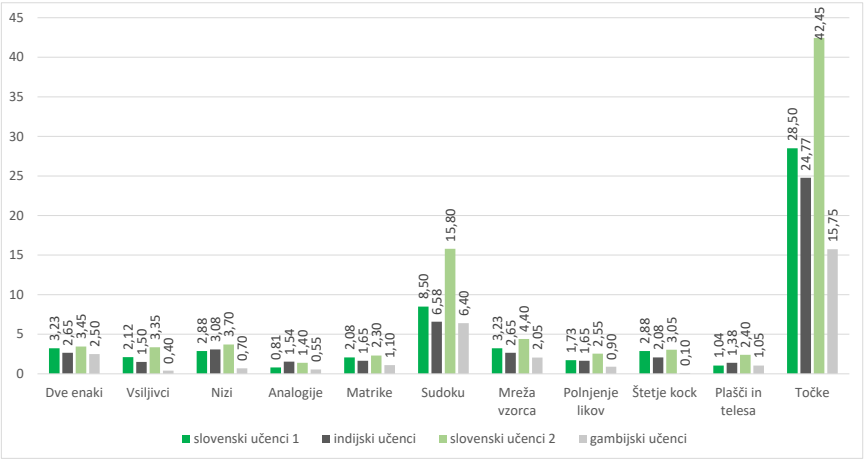
Statistično značilno razliko zaznamo tudi pri skupnem rezultatu testa ($p < 0,001$), slovenski učenci so v povprečju dosegli boljši rezultat. Slovenski učenci so torej izkazali niz spretnosti, ki so potrebne za reševanje problemov ter ustreznega učenja iz preteklih izkušenj.

Tabela 5: Uspešnost indijskih in gambijskih učencev pri vseh sklopih nalog

	indijski učenci (N=26)	gambijski učenci (N=20)	MW U test	
	$\bar{x}$	$\bar{x}$	testna statistika	p
Dve enaki*	3,23	2,50	149,500	0,009
Vsiljivci*	2,12	0,40	93,000	< 0,001
Nizi*	2,88	0,70	74,500	< 0,001
Analogije	0,81	0,55	230,000	0,453
Matrike*	2,08	1,10	136,500	0,005
Sudoku	8,50	6,40	209,500	0,261
Mreža vzorca*	3,23	2,05	165,500	0,029
Polnjenje likov*	1,73	0,90	144,500	0,008
Štetje kock*	2,88	0,10	47,500	< 0,001
Plašči in telesa	1,04	1,05	254,500	0,897
Skupne točke vseh nalog*	28,50	15,75	39,000	< 0,001

*Razlika med skupinama je statistično značilna ($p < 0,05$).

Tudi pri primerjavi rezultatov indijskih in gambijskih učencev zaznamo statistično značilne razlike, is sicer so indijski učenci dosegli statistično značilno boljši rezultat ($p < 0,05$) pri vseh nalogah razen pri nalogah analogije, sudoku ter plašči in telesa. Razloge za boljši rezultat lahko iščemo v okolju, samodejavnosti in sociokulturnih vplivih. Izhajamo iz premise, da sta razvoj in izražanje kognitivnih zmožnosti neločljivo povezana z naučenimi sposobnostmi in navadami ter vplivom okolja (družinskega, vzgojno-izobraževalnega, družbenega okolja). Čeprav ima genetika večjo vlogo kot okolje pri ustvarjanju razlik v IQ med posamezniki, do statistično pomembnih razlik ni prišlo.



Graf 1: Primerjava rezultatov pri vseh sklopih nalog in med vsemi skupinami učencev

(i) Naloge vidnega zaznavanja

Pri nalogah »dve enaki« gre za sposobnost natančnega opazovanja, primerjanja in razlikovanja na podlagi podobnosti, kjer so morali biti pozorni na številne podrobnosti, ki so jim med različnimi podobami pomagale najti dve popolnoma enaki (Bucik et al., 2013). Pri nalogah vidnega zaznavanja so v vseh primerih slovenski učenci dosegli boljše rezultate kot indijski in gambijski vrstniki. V sklopu te naloge je bilo mogoče zbrati največ štiri točke. Slovenski učenci 1. skupine so pri tej nalogi zbrali povprečno $\bar{x}$=3,23 točke, druge skupine $\bar{x}$=3,45 točke, medtem, ko indijski $\bar{x}$=2,65 točke, gambijski pa $\bar{x}$=2,50 točke. Zanimala nas je tudi statistična pomembnost rezultatov pri ugotavljanju povezanosti med obiskovano osnovno šolo in rezultati nalog vidnega zaznavanja »dve enaki«, kar smo preverili s χ^2 preizkusom oz. razmerjem verjetij, ki je pokazal da gre za statistično značilno povezanost (p=0,047).

Vse štiri točke je skupno zbralo skupno 29 (31,5 %) nadarjenih učencev, od tega enajst (42,3 %) slovenskih iz 1. skupine, šest (23,1 %) indijskih učencev, deset slovenskih učencev (50,0 %) iz 2. skupine ter dva (10,0 %) gambijska učenca.
Naslednja vrsta nalog vidnega zaznavanja so naloge z naslovom »vsiljivci«, kjer gre ponovno za sposobnost natančnega opazovanja, primerjanja in razlikovanja na podlagi podrobnosti. V tem primeru so bile sličice ponekod obrnjene, zato so morali biti učenci še posebej pozorni na vse malenkosti, ki so jim pomagale razlikovati med na videz enakimi podobami. Ugotavljamo, da so se slovenski učenci druge skupine v prvih treh nalogah sklopa vsiljivci bistveno bolje odrezali kot njihovi indijski in gambijski vrstniki. Pri četrti nalogi, ki naj bi bila med vsemi v drugem sklopu najtežja, so nekoliko boljše rezultate v povprečju dosegli Indijci.
Naloge vsiljivci je v celoti pravilno rešilo devetnajst posameznikov (20,7 %), od tega štirje slovenski učenci iz prve skupine, štirje indijski in enajst učencev iz druge slovenske skupine. V Gambiji noben učenec naloge ni rešil v celoti pravilno, 75 % gambijskih otrok pa sploh ni zbralo nobene točke, medtem ko skupno gledano 33,5 % otrok ni zbralo nobene točke. Slovenski otroci prve skupine so povprečno zbrali $\bar{x}$=2,12 točke, druge skupine $\bar{x}$=3,35 točke, indijski učenci $\bar{x}$=1,50 točke, gambijski pa $\bar{x}$=0,40 točke. Razlog za slabše rezultate vseh učencev bi lahko bil vpliv nalog »dve enaki«, kjer so učenci v vrsti na videz podobnih predmetov iskali po dva enaka, medtem ko so bile pri nalogi »vsiljivci« sličice rotirane v vse smeri.

(ii) Naloge prepoznavanja pravil ali zakonitosti

Pri nalogah naslovom »nizi« gre za sposobnost prepoznavanja pravil in zakonitosti, po katerih se določeni elementi menjujejo v nizu. Učenci so pri tem morali biti pozorni na spremembe od sličice do sličice, jih zaznati in jih razumeti kot pravilo ter tako na podlagi določenih podatkov predvideti, kaj sledi (Bucik et al., 2013). Rezultati testiranih skupin učencev so si zelo podobni pri obeh skupinah slovenskih učencev in indijskih učencih, medtem ko so gambijski učenci dosegli opazno slabše rezultate. Vse štiri možne točke je skupno doseglo 45 (48,9 %) učencev, od tega 13 slovenskih iz prve skupine (50,0 %), 14 indijskih (53,8 %), 17 učencev iz druge slovenske skupine (85,0 %) ter samo 1 gambijski učenec. Največ gambijskih otrok (12 oz. 60 %) pri nalogi ni zbralo nobene točke. Test povezanosti spremenljivk je potrdil, da sta spremenljivki narodnost oziroma osnovna šola ter rezultati naloge nizi med seboj statistično značilno povezani ($p < 0,001$).

Slovenski otroci prve skupine so v povprečju zbrali $\bar{x}$=2,88 točke, indijski $\bar{x}$=3,08 točke, slovenski otroci druge skupine $\bar{x}$=3,70 točke, gambijski pa $\bar{x}$=0,70.
Pri nalogah »slikovni sudoku« gre za sposobnost razporejanja sličic po točno določenem pravilu, razporejanja sličic v prazna polja mreže 4x4. Ker so te naloge med zahtevnejšimi, smo predpostavljali, da jih bo v celoti pravilno rešil le majhen del učencev. V sklopu nalog je bilo možno zbrati 19 točk. Najvišje doseženo število točk je bilo 17, in sicer s strani slovenskih učencev druge skupine. Slovenski učenci druge skupine so pri tej nalogi izstopali, saj so v povprečju dosegli $\bar{x}$=15,80 točk, slovenski učenci prve skupine pa že opazno manj, $\bar{x}$=8,50 točk, indijski učenci so dosegli le $\bar{x}$=6,58 točk, gambijski pa $\bar{x}$=6,40 točk.
Pri slovenskih učencih prve skupine jih je največ, to je 13, doseglo med 7 in 9 točk, pri indijskih učencih jih je 13 doseglo med 5 in 8 točk, pri slovenskih učencih druge skupine prevladuje porazdelitev med 16 in 17 točkami (15 učencev), med gambijskimi učenci pa jih je največ, kar 6, ki niso dosegli niti ene točke. Test povezanost spremenljivk je potrdil statistično značilno povezavo glede rezultata in narodnosti ($p < 0,001$).

(iii) Naloge ugotavljanja in prepoznavanja odnosov
Prve naloge so naloge z naslovom »analogije«, kjer gre za sposobnost ugotavljanja in vzpostavljanja odnosov med različnimi stvarmi. Učenci so morali na podlagi prvega narisanega para sličic najti manjkajočo sličico drugemu paru, pri čemer je bilo pomembno, da so pri narisanem paru najprej ugotovili, v kakšnem odnosu sta sličici in tako odnos prenesti na drugi par ter predvideti, katera izmed ponujenih možnosti bo pravilna rešitev (Bucik et al., 2013).
Z izjemo druge naloge so se pri reševanju analogij bistveno bolje odrezali indijski učenci. V vseh treh primerih namreč slovenske učence prve skupine prekašajo za več kot polovico. Razlog za to bi lahko bil v boljših sposobnostih ugotavljanja in vzpostavljanja odnosov med predmeti ali pa zgolj v natančnejšem opazovanju. Pri omenjenem sklopu nalog so učenci ponovno lahko zbrali maksimalno štiri točke. Po tri in štiri točke je skupno zbralo osem (30,7 %) indijskih učencev, ter dva slovenska prve skupine (7,6 %) in trije slovenski učenci druge skupine (15,0 %). Prav tako je naloge v celoti narobe rešilo 14 (53,8 %) slovenskih učencev prve skupine, 4 (20,0 %) slovenski učenci druge skupine ter kar 13 (65,0 %) gambijskih učencev, medtem ko je bilo indijskih, ki ne bi dosegli nobene točke, devet (34,6 %).

Test povezanosti spremenljivk je potrdil, da sta spremenljivki narodnost oziroma osnovna šola ter rezultati naloge analogije med seboj statistično značilno povezani ($p = 0,032$). Slovenski učenci prve skupine so pri tem v povprečju zbrali le $\bar{x}=0,81$ točke, učenci druge skupine $\bar{x}=1,40$ točke, medtem ko indijski $\bar{x}=1,54$ točke, gambijski otroci pa najmanj, $\bar{x}=0,55$ točke.

Pri nalogah, imenovanih »matrike«, gre prav tako za sposobnost ugotavljanja in vzpostavljanja odnosov med različnimi stvarmi ter kombiniranja posameznih lastnosti. Učenci so morali ugotoviti, v kakšnem odnosu so sličice v matriki (mreža 3x3), pri čemer so morali biti zelo pozorni, saj so se te razlikovale po več lastnostih. Boljše rezultate so dosegli nadarjeni slovenski učenci prve in druge skupine. Vse točke pri tem sklopu je doseglo le 10 učencev (10,9 %), od tega dva slovenska (7,7 %) prve skupine, en indijski (3,8 %), šest učencev (30,0%) slovenske druge skupine in en gambijski učenec (5,0 %).

Vse skupine učencev so se v primerjavi z gambijskimi bolje odrezale, saj je večina preostalih zbrala med 2 in 3 točke, v Gambiji pa največji odstotek otrok (45 %) ni zbral nobene točke. Gre za statistično značilno povezanost med narodnostjo oz. šolo in doseženim številom točk ($p=0,018$). Slovenski učenci so v povprečju osvojili $\bar{x}=2,08$ točke in $\bar{x}=2,30$ točko, indijski pa $\bar{x}=1,65$ točke. Gambijci so dosegli najnižji rezultat, in sicer $\bar{x}=1,10$ točko.

(iv) *Naloge sklepanja o celoti*

Pri nalogah »dopolnjevanje mreže vzorca«, gre poleg sposobnosti vidnega zaznavanja, prepoznavanja drobnih podobnosti in razlik ter prostorske predstavljivosti za sposobnost sklepanja o celoti. Učenci so za manjkajoče okence v mreži vzorca morali poiskati tisto, ki edino pravilno dopolni mrežo.. V tem sklopu nalog je bilo mogoče zbrati največ pet točk.

Slovenski učenci so v povprečju osvojili $\bar{x}=4,40$ in $\bar{x}=3,23$ točke, medtem ko indijski $\bar{x}=2,65$ točk, gambijski pa $\bar{x}=2,05$. Največje število otrok je v nalogi »mreže vzorcev« zbralo po 4 točke (34 učencev oz. 37,0 %), pri čemer izstopata obe skupini slovenskih učencev, med katerimi jih je 50 % doseglo 4 točke, pri drugi skupini pa še dodatnih 9 (45 %) vse možne točke, torej 5 točk. Med indijskimi učenci jih je največ doseglo 2 točki (8 oz. 30,8 %) in 3 točke (10 oz. 38,5 %), med gambijskimi pa izstopajo učenci, ki niso dosegli nič točk (6 oz. 30,0 %) ter tisti, ki so dosegli 4 točke (30,0 %). V celoti napačno rešenih nalog med učenci ostalih narodnosti ni bilo. Povezanost med spremenljivkama je statistično značilna ($p < 0,001$).

(v) Naloge prostorske predstavljivosti

Pri nalogah »štetje kock«, kjer gre za sposobnost dobre prostorske predstavljivosti so učenci morali prešteti vse kocke. Učenci slovenske osnovne šole, prva in druga skupina učencev, so dosegli boljše rezultate kot indijski in gambijski osnovnošolci.

Pri tem sklopu nalog so učenci lahko zbrali največ sedem točk. Vseh pet primerov nalog je v celoti pravilno rešilo le sedem (7,6 %) učencev, ki so si posamično prislužili po sedem točk. Med temi so en slovenski učenec prve skupine, trije indijski in trije slovenski učenci druge skupine. Podobno število učencev si je pridobilo 6 točk (6 oz. 6,5 %) učenci, med katerimi so tokrat trije slovenski učenci prve skupine, en indijski učenec in dva učenca slovenske druge skupine. Kar veliko učencev (41 oz. 44,6 %) je napačno preštelo vse kocke.

Med njimi so štirje slovenski učenci prve skupine, deset indijskih učencev, 8 učencev slovenske druge skupine ter kar 19 gambijskih učencev. Slovenski učenci prve skupine so tako v povprečju osvojili $\bar{x}$=2,88 točke, medtem ko indijski $\bar{x}$=2,08 točko. V povprečju so Slovenci druge skupine zbrali $\bar{x}$=3,05 točke, Gambijci pa le $\bar{x}$=0,10 točke.

Pri nalogah »plašči in telesa«, gre za prostorsko predstavljivost, saj naloge lahko pravilno rešimo le v primerih, če si geometrijsko telo znamo predstavljati tudi razgrnjeno v ploskev in obratno. Učenci so morali pri tem natančno opazovati in biti pozorni na različne postavitve teles v prostoru, na barvne ploskve in vzorce na njih, da so lahko našli pravilno rešitev. V tem sklopu nalog so učenci skupno lahko osvojili največ štiri točke. Slovenski učenci prve skupine so v povprečju zbrali $\bar{x}$=1,04 točko, medtem ko indijski $\bar{x}$=1,38 točke. Največ točk so v povprečju dosegli slovenski učenci druge skupine, in sicer $\bar{x}$=2,40 točke, medtem ko so gambijski učenci v povprečju dosegli $\bar{x}$=1,06 točke, primerljivo torej s prvima dvema skupinama.

Vse možne točke so sicer pri tej nalogi zbrali le trije učenci, 1 indijski učenec in dva učenca druge slovenske skupine. Največ slovenskih otrok prve raziskovalne skupine je doseglo eno točko (38,5 %), visok je bil tudi delež tistih brez točk (30,8 %). Med indijskimi učenci so izstopali tisti z eno (42,3 %) ali dvema točkama (34,6 %), medtem ko je med slovenskimi učenci druge raziskovalne skupine največ takšnih, ki so zbrali 3 točke (40,0 %), sledijo tisti z dvema točkama (30,0 %).

Največ gambijskih otrok (30 %) pa ni zbralo nobene točke. Štirje indijski učenci (14,4 %) v tem sklopu nalog niso dosegli niti ene točke, medtem ko je brez točk prav tako ostalo še enkrat več slovenskih učencev prve skupine 8 (30,8 %) ter 6 oz. 30 % gambijskih učencev. Nobeden izmed gambijskih otrok ni dosegel več kot 2 točki. Skupno je največ otrok zbralo po 2 točki (9 oz. 31,5 %). Povezanost med spremenljivkama je statistično pomembna ($p = 0{,}001$).

Slovenski učenci so se od desetih sklopov nalog bolje kot njihovi indijski vrstniki skupno odrezali kar pri sedmih sklopih nalog, pri štirih nalogah smo zaznali statistično značilno razliko. Vseh točk so v povprečju zbrali $\bar{x}=28{,}50$, medtem ko indijski $\bar{x}=24{,}77$ točke, pri čemer gre za statistično značilno razliko ($p=0{,}024$). Ugotavljamo, da so bili učenci slovenske osnovne šole pri reševanju miselnih nalog bolj uspešni kot njihovi indijski vrstniki. Sicer gre za zelo majhen vzorec, zato rezultatov nalog ne moremo posplošiti na celotno populacijo.

V gambijskih šolah podobnih nalog sploh ne rešujejo, medtem ko imajo slovenski otroci povsod dostop do podobnih miselnih nalog. Sploh v sklopu nalog prostorske predstavljivosti, pri nalogah »štetje kock« in »plašči in telesa«, so slabši rezultati gambijskih učencev razumljivi, saj didaktičnih pripomočkov, ki bi pomagali pri razumevanju takšnih nalog, v Gambiji nimajo.

Primerjava skupnega števila doseženih točk med vsemi štirimi skupinami pokaže, da izstopajo slovenski učenci druge raziskovalne skupine, ki so v povprečju dosegli $\bar{x}=42{,}45$ točk, sledijo slovenski učenci prve raziskovalne skupine s $\bar{x}=28{,}50$ točkami, takoj za njimi so indijski učenci, ki so v povprečju dosegli $\bar{x}=24{,}77$ točke in gambijski učenci z $\bar{x}=15{,}75$ točkami. Parne primerjave z MW U testom pri vseh skupinah pokažejo statistično značilno razliko med skupnim številom doseženih točk ($p < 0{,}05$).

Sklepne ugotovitve

Pri mednarodni primerjalni analizi kognitivne učinkovitosti nominiranih (evidentiranih) nadarjenih slovenskih (2 različni skupini), indijskih in gambijskih učencev pri reševanju miselnih nalog, smo bili osredotočeni na logično-matematično in prostorsko inteligentnost v povezavi z družbenim okoljem, iz katerega prihajajo osemletni učenci. Z MWU testom smo testirali vse posamezne skupine med seboj, s hi-kvadrat testom pa razlike med porazdelitvijo točk glede na vse skupine hkrati.

Ugotovili smo, da se rezultati testiranih skupin med seboj le nekoliko razlikujejo, razlike so večje pri skupini gambijskih otrok. Testiranje povezanosti med doseženim številom točk ter okoljem, iz katerega učenci prihajajo, je v primerih vseh nalog pokazalo statistično pomembnost rezultatov ($p < 0,05$). Dosežene točke pričajo, da so se nadarjeni slovenski učenci bolje odrezali kar pri sedmih nalogah od desetih (dve enaki, vsiljivci, slikovni sudoku, matrike, dopolnjevanje mreže vzorca, polnjenje likov in štetje kock), vendar z izjemo naloge »polnjenje likov«, kjer v primerjavi z indijskimi učenci Pearsonov χ^2 preizkus ni pokazal statistične pomembnosti rezultatov. Menimo, da je razlog za to v premajhnem vzorcu testiranih učencev, zato na podlagi tako majhnega odstopanja rezultatov ne moremo dokazati povezanosti spremenljivk. Pri sklopu nalog »plašči in telesa« pa so bili rezultati razdvojeni; pri nalogah, kjer je bilo potrebno s pomočjo danega plašča ugotoviti, katero telo lahko sestavimo iz le-tega, so boljše rezultate dosegli indijski učenci, slabše gambijski.

Pri nalogah, kjer pa je bilo potrebno s pomočjo danega telesa ugotoviti, kateri plašč dobimo, če telo razgrnemo v ploskev, pa obratno, prednjačili so slovenski učenci. Po seštevku točk testiranih učencev smo ugotovili, da so indijski učenci pri teh nalogah zbrali več točk. Na dosežene rezultate je lahko vplivalo več dejavnikov, čeprav smo poskušali ustvariti čim boljše in čim bolj podobne razmere, v katerih bi testiranje potekalo. Največ pravilnih odgovorov (več kot tri četrtine vseh točk, tj. 57 točk) sta zbrala le dva nadarjena učenca – slovenski učenec, ki je zbral 45 točk in indijski, ki je zbral 44 točk, gambijski učenec jih je zbral 17.

Slovenski učenci so v primerjavi z gambijskimi vrstniki bolje reševali nalogo »slikovni sudoku«, slabše pa nalogo »analogije«. Pri gambijskih učencih je bila najbolje rešena naloga »dve enaki«, »štetje kock« pa najslabše rešena naloga. Slovenski učenci so torej v primerjavi z afriškimi vrstniki bolje reševali naloge o pravilih in zakonitostih, slabše pa naloge o prepoznavanju odnosov in prostorski predstavljivosti. Gambijski otroci pa so bolje reševali naloge sklepanja o celoti, med slabše rešene naloge pa so se uvrstile naloge o prostorski predstavljivosti.

Čeprav so bili za izvedbo reševanja nalog izbrani otroci, ki so dosegali nadpovprečne rezultate (evidentirani nadarjeni), je razlogov za slabši uspeh gambijskih otrok veliko: od slabšega izobraževalnega sistema, slabših razmer v državnih šolah, strokovne usposobljenosti pedagoškega kadra, dostopa do učil in učnih pripomočkov, uporabe podobnih kompleksnejših nalog v učnem procesu idr.

Čeprav je bila raziskava v Gambiji opravljena (tako kot v Indiji) na zasebni osnovni šoli, ki se zgleduje po evropskih izobraževalnih sistemih, so razlike še vedno velike. Naj ponovno poudarimo, da smo pri testiranju želeli ustvariti čim boljše in čim bolj podobne razmere, v katerih je potekalo testiranje.

Rezultatov zagotovo ni moč posploševati, prav tako je težko enačiti inteligentnost in nadarjenosti med vzhodnimi in zahodnimi svetovnimi kulturami, ki se med seboj bistveno razlikujejo. Raziskave o razlikah med kognitivnimi slogi ljudi, vzgojenimi v vzhodni in zahodni kulturi se naslanjajo predvsem na preobsežno uporabo nekaterih zahodnih definicij inteligentnosti in nadarjenosti, kot sta npr. Sternbergova ali Gardnerjeva. V zadnjih letih sta Sternberg in Grigorenko (APA, 2003) raziskovala tudi koncepte inteligentnosti v Afriki. V Keniji so ugotovili, da so ideje o inteligenci sestavljene iz štirih širokih konceptov med katerimi je samo eden, »rieko«, povezan s tradicionalnimi zahodnimi interpretacijami inteligentnosti. Preučevanje inteligence in nadarjenosti v različnih kulturah je torej lahko svojevrsten način izziva konvencionalnih zahodnih idej o inteligentnosti. Slednje je potrdila tudi pričujoča raziskava.

Splošne ali specifične nadarjenosti se torej iz sposobnosti in zmožnosti (potencialov) lahko skozi razvoj oziroma procese učenja, spodbujenih z ustreznimi posredniki osebnostne in okoljske narave (tukaj izpostavljamo predvsem družinsko učno okolje, družinsko vzdušje, razredno klimo, odzive vrstnikov, sorojencev, staršev, učiteljev, idr.), izrazijo v značilnih vedenjih, kar lahko v ugodnih okoliščinah privede do (nadpovprečnih) dosežkov.

Predvsem pa je pomembno poudariti dejstvo, da smo v Zahodni kulturi nagnjeni k zgodnjemu spodbujanju logično-matematičnega mišljenja oz. od vrtca dalje spodbujamo pri otrocih t.i. kognitivni trening oz. kognitivne strategije, ki prispevajo k učinkovitejšim spretnostim pri reševanju matematičnih problemov. Kognitivno delovanje in uporaba matematično-logičnega mišljenja namreč vodita do krepitve razvoja mišljenja ter matematične pismenosti (Lupu, 2014). Slovenija pri tem pričakovano izstopa, saj se naši učenci srečujejo z uporabo matematike v realnih življenjskih situacijah skozi celoten vzgojno-izobraževalni sistem. V slovenski šolskih kurikulih je predmet matematika eden od temeljnih splošno-izobraževalnih predmetov v šoli. Pri pouku matematike si učenci oblikuje osnovne matematične pojme in strukture, kritično mišljenje, miselne procese, sposobnosti za ustvarjalno dejavnost, formalna znanja in spretnosti ter spoznajo tudi praktično uporabnost matematike, ki je tesneje povezan z matematično pismenostjo (Žakelj, 2003).

V Indiji je situacija podobna, zato so lahko iz vidika šolskega kurikuluma in poudarjanja matematike, rezultati primerljivi. Prav tako so nekateri indijski posamezniki dosegli visoke /nadpovprečne rezultate. V Gambiji pa je šolski kurikulum, učni načrt za matematiko v OŠ, kompetence, ki naj bi jih pridobili, prav tako dokaj primerljiv slovenskim, čeprav rezultati pri izbranih nalogah, kažejo, da so na izvedbeni ravni na področju logično-matematične inteligentnosti še vedno prisotne številne vrzeli, ki jih lahko pripišemo kulturnemu in družbenemu okolju otrok.

Menimo, da kljub temu, da smo izhajali iz evidentiranih nadarjenih otrok, preprosto prevajanje »zahodnega« testa v lokalni jezik v Indiji in Gambiji, ni dovolj. Ključnega pomena je namreč, da vsak test prilagodimo potrebam in vrednotam kulture, v kateri se bo uporabljal.

Summary

The development and expression of intelligence are inextricably linked to three important factors in human functioning: (i) cognitive abilities, (ii) learned skills and habits, and (iii) appropriate motivation, i.e., a coordinated interaction of hereditary factors, environmental influences, and one's own activities (Bucik et al., 2013). In this paper, we present a comparative analysis between registered gifted Slovenian, Gambian and Indian students in which we tried to find out how they perform at completing selected mental tasks. Based on the research question, we set the following goals: (1) to determine how successful gifted Slovenian, Indian, and Gambian students are on individual mental tasks; (2) to determine on which types of mental tasks gifted students from the Western, Eastern, and African worlds perform best or worst. In our international comparative analysis of gifted students' cognitive performance on mental tasks, we focused on logical-mathematical and spatial intelligence in relation to the social environment from which the students came. We used the MWU test to test each individual group against the others, and the Hi-square test to test the differences between the score distributions of all groups simultaneously. We found that the scores of the tested groups differed only slightly, with larger differences in the group of Gambian children.

Testing the relationship between the number of points achieved and the environment from which the students came yielded statistical significance for results in all tasks ($p < 0.05$).

The achieved scores show that the gifted Slovenian students performed better in as many as seven out of ten tasks, except for the task "Filling in Letters", where the Pearson's 2 test did not show statistical significance compared to the Indian students. After adding the scores of the tested students, we found that the Indian students performed better on these tasks. These results may have been influenced by several factors, although we tried to create the best and most similar conditions under which the tests would take place. Only two talented students received the maximum correct answers (more than three-quarters of all scores, i.e., 57 points) - a Slovenian student who scored 45 points and an Indian student who scored 44 points, and a Gambian student who scored 17 points.

Compared to their Gambian classmates, the Slovenian students completed the "Picture Sudoku" task better and the "Analogy" task worse. For the Gambian students, the "Two Equals" task was the best and the "Counting Cubes" task was the worst.

Thus, compared to their African peers, the Slovenian students were better at completing tasks on rules and laws but worse at completing those on recognizing relationships and spatial representation.

The Gambian children, on the other hand, completed the logical reasoning tasks better overall, while the spatial representation tasks were among those showing the poorest performance. Although children who scored above average (i.e., who were classified as gifted) were selected to complete the tasks, there are many reasons for the poor performance of Gambian children: a weaker education system, poorer conditions in public schools, professional qualifications of teachers, access to teaching and learning materials, use of similar, more complex tasks in the learning process, etc. Although the study in The Gambia (as well as in India) was conducted in a private elementary school modelled on European educational systems, the differences were nevertheless large. The results certainly cannot be generalized, and it is also difficult to equate intelligence and talent between Eastern and Western world cultures, which differ considerably. Research on the differences between the cognitive styles of people raised in an Eastern and a Western culture relies mainly on the overuse of some Western definitions of intelligence and talent, such as those by Sternberg or Gardner.

Most importantly, we need to emphasize that in Western culture, we tend to promote logical-mathematical thinking at an early age, i.e., we encourage children from kindergarten onward to engage in cognitive training or cognitive strategies that contribute to greater ability in solving mathematical problems.

We believe that even though we structure the study around the use of children who have been recognized as gifted, it is not enough to simply translate the "Western" test into the local language in India and The Gambia. It is critical that any test be adapted to the needs and values of the culture in which it will be used.

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ONLINE FORMATIVE ASSESSMENT IN MATHEMATICS EDUCATION: PROSPECTIVE PRIMARY TEACHERS' UNDERSTANDING OF RATIONAL NUMBERS

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Abstract/Izvleček This study sheds light on prospective primary teachers' understanding of rational numbers. This is an experimental study that aims to evaluate prospective primary teachers' mathematical and didactic knowledge of rational numbers through online formative assessment. The participants were 38 prospective primary teachers from a primary teacher education study program at a public university in Pekanbaru, Riau, Indonesia. This study indicates that the prospective teachers have insufficient knowledge of rational numbers, and they possess better mathematical than didactic knowledge. This study also reveals a significant increase in prospective teachers' mathematical and didactic scores from the first test to the second test.

Spletno formativno ocenjevanje pri pouku matematike: Kako bodoči osnovnošolski učitelji razumejo racionalna števila?
V članku se osredinjamo na vprašanje, kako bodoči osnovnošolski učitelji dojemajo racionalna števila. Predstavljena je eksperimentalna raziskava, katere osnovni namen je oceniti matematično in didaktično znanje bodočih učiteljev na področju racionalnih števil pri spletnem formativnem ocenjevanju. Udeleženci v raziskavi so bodoči osnovnošolski učitelji (n = 38) na študijskem programu izobraževanja učiteljev na javni univerzi v Pekanbaruju, Riau, Indonezija, in sicer na programu matematika za višje razrede osnovne šole. Rezultati raziskave kažejo, da izkazujejo bodoči osnovnošolski učitelji pomanjkljivo znanje o racionalnih številih ter da njihovo didaktično znanje presega njihove matematične zmožnosti. Obenem raziskava kaže pomembne razlike v matematičnem in didaktičnem znanju pred testom in po njem.

Keywords:
mathematical and didactic knowledge; online formative assessment; rational numbers; teacher knowledge

Ključne besede:
matematično in didaktično znanje; spletno formativno ocenjevanje; racionalna števila; znanje učiteljev

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Introduction

Digital technology has a significant role in learning and teaching in the 21st century, especially during the Coronavirus disease (COVID-19) outbreak. The role ranges from learning management (Hoyos, 2012) to implementing online assessments or tests (Drijvers et al., 2014). Many studies have shown that teachers and students have a positive attitude toward using digital technology in education (Afify, 2019; Drijvers et al., 2014; Jupri, Drijvers, and van den Heuvel-Panhuizen, 2015; Putra, Witri, and Yulita, 2019). The exploitation of technology for online assessment, when used effectively, can be particularly valuable in the assessment of 21st-century learning (Boitshwarelo et al., 2017). Online assessment in mathematics is a challenge because mathematics learning involves not only texts but also mathematical symbols. A study conducted by Drijvers et al. (2014) has confirmed that students who studied and did a test using an online algebra environment scored slightly below students benefiting from offline learning. One of the main factors involved was the schools' experience with digital technology in learning and teaching. Nevertheless, online assessment is highly efficient, fast and reliable, and beneficial for many students (Gipps, 2005) because digital technology can record student answers and give feedback directly. Teacher feedback is essential for student learning, as students can obtain rapid, specific feedback on their performance (Ho et al., 2018). In addition, students will likely be encouraged to employ online peer and collaborative evaluations (Gipps, 2005). In this study, we are interested in investigating how online assessment is applied in mathematics education, especially in primary teacher education institutions. This study focuses on prospective primary teachers' knowledge of rational numbers because this topic is complex for students to learn and for teachers to understand and teach (Siegler and Lortie-Forgues, 2017).

Online assessment in mathematics education

In 2003, Graff (2003) conducted a study on using online learning and assessment methods. He defined online assessment as a method of using computers to deliver and analyse tests or exams, and it has been used since the 1970s. The advantage of online assessment is that it is possible to give students immediate feedback on their understanding, especially in large classes (Pezzino, 2018).

Online assessment has also been used in mathematics education (Brouwer et al., 2009; Drijvers et al., 2014; Pezzino, 2018).

Brouwer et al. (2009) conducted a study focusing on using frequent online assessments powered by a mathematical engine named Maple TA. They found that students in the bachelor courses in mathematics responded positively to online assessment, and the use of online assessment tools was straightforward. Furthermore, the interactive online assessment programme in mathematical exercises also provided rapid feedback (Brouwer et al., 2009). Similar results were also found in a study by Pezzino (2018): the students were very impressed with online assessment because they received feedback and support. Moreover, online Maple TA-based assessment could have been the only factor that helped students considerably enhance their performance level in class (Pezzino, 2018). In general, there are two types of assessment (Graff, 2003), and these also apply to online assessment in mathematics education. The first of these, formative assessment, is defined as an evaluation conducted during the course presented as a means of monitoring student learning. Formative assessment has some benefits, such as monitoring the learning experience and intervening early, learning from errors, offering improvement suggestions, and meeting individual needs (Dopper and Sjoer, 2004; Pastor, 2011). The second type, summative assessment, aims to determine examination outcomes, and it is mainly given to students at the end of a period of study. Summative assessment tests whether the predetermined learning results align with the programmed objectives (Mohamadi, 2018). The present study focuses on the online formative assessment of rational numbers given to prospective primary teachers during their studies because this tool has much to offer in terms of improving student learning experience when some factors are considered, such as feedback on each item and a guided student learning process (Dopper and Sjoer, 2004). The online formative assessment in this study aims to monitor prospective primary teachers' understanding of rational numbers. This topic is part of a whole course of mathematics education for primary schools in upper grades. With the advancement of digital technology in education, students can receive feedback from teachers to improve their learning process and develop a better understanding of knowledge.

Teachers' knowledge of rational numbers

Teachers' knowledge of rational numbers has been the main focus of many studies in mathematics education (Browning, Edson, Kimani, and Aslan-Tutak, 2014; Depaepe et al., 2015; Ma, 1999; Newton, 2008; Putra, 2019a, 2019b; van Steenbrugge, Lesage, Valcke, and Desoete, 2014).

Most studies have shown that teachers have difficulty with and misconceptions about rational numbers and their operations. For example, a seminal work by Ma (1999) revealed that teachers in the USA have struggled to explain the meaning of the division of fractions. Ma (1999) identified teachers' difficulties in both subject-matter knowledge of dividing fractions and knowledge of how to teach this topic. Similarly, Güler and Çelik (2019) revealed that prospective teachers performed well in evaluating what misconceptions students may have shared in the scenario. However, most of them did not perform well in delivering content in terms of educational strategies. These findings also apply to the Indonesian perspective and in-service teachers' knowledge of rational numbers (Putra, 2018, 2019b).

Two main issues underlie students' and teachers' inadequate understanding of rational number arithmetic: inherent sources and culturally contingent issues (Siegler and Lortie-Forgues, 2017). Concerning the first issue, inherent sources of difficulty relate to students' understanding of individual rational numbers, the relationship between rational and whole number arithmetic, and the relationships among rational number operations. For instance, to add two rational numbers, $\frac{1}{2} + \frac{1}{4}$, a student cannot directly apply a procedure of adding both numbers based on their position, but he/she needs to change them into the same denominator. Siegler and Lortie-Forgues (2017) pointed out that those are independent of the educational system and the community in which learners live. On the other hand, culturally contingent sources of difficulty differ depending on the particulars of student lives. Those cultural contingent sources include teachers' knowledge, textbooks, and language. For instance, Indonesian school textbooks provide only about 10% context-based tasks (Wijaya et al., 2015), so explaining the meaning of partitive reasoning of fraction division using contextual situations could be a challenge for many teachers in Indonesia because they are not as familiar with what appears in the textbook.

Concerning inherent difficulties, many teachers tend to teach students based on a single meaning of rational numbers, namely a part-whole relationship (Putra, 2018).

Other meanings of rational numbers, such as ratio, operator, quotient, and measurement (Charalambous and Pitta-Pantazi, 2007), are rarely given attention by teachers in teaching fractions. The meaning of rational numbers as quotient, for instance, will lead students to understand that a/b is a single number, so they can use this understanding to solve arithmetic operations of rational numbers. Students may understand why adding two fractions cannot be done based on their positions instead of changing fractions into fractions with a common denominator and adding numerators.

Understanding individual rational numbers leads students to know the relations between rational and whole number arithmetic and the relations among rational numbers.

The second issue of students' and teachers' understanding of rational numbers is culturally contingent. Teacher knowledge is the central aspect of this difficulty. Many teachers build their knowledge based on their learning experiences in primary schools and instruction developed in pedagogical institutions (Putra, 2019b, 2019a). For example, some studies in the literature show that many prospective teachers struggled to explain the meaning of multiplication and division of fractions when they graduated from teacher education programs (e.g. Putra, 2018, 2019b). Another example is to figure out the density of rational numbers, many prospective teachers provided different answers to find how many numbers are between 2/5 and 4/5 and how many numbers are between 0.4 and 0.8. Most prospective primary teachers did not realise that the two tasks were the same (Putra, 2019b). Mathematics textbooks constitute another cultural contingent because these provides fewer opportunity-to-learn, context-based tasks for students (Wijaya et al., 2015) and pay more attention to procedural tasks and techniques. In addition, the language used in learning fractions in primary school in Indonesia also becomes culturally contingent. For example, a fraction is always interpreted as a part of a whole, such as a fraction of 1/3 in Indonesian, 'one-third' translating into one out of three parts.

Teachers' difficulties and challenges provide open questions for many researchers to investigate. In the present study, we focus on prospective teachers' understanding of rational numbers and their operations. This study aims to reveal the extent to which the educational system and the culture within which prospective teachers live affect their understanding of rational numbers. Specifically, we formulate the research question for this study as "To what extent is prospective teachers' understanding of rational numbers assessed through online formative assessment?"

Research Methodology

Participants

Participants were second-year prospective primary teachers (2 men and 36 women) from a primary teacher education study program at a public university in Pekanbaru, Riau, Indonesia. All participants were in the even semester of the 2019/2020 academic year, and they were taking a course on mathematics education for the upper grades of primary school to teach mathematics from grades 4 to 6.

For half a semester, the mathematics instruction focused on fractions and measurements. It subsequently continued with didactic projects related to designing media and tools in mathematics, task design, lesson plans, and teaching scenarios.

Those participating in this study had taken two foundational courses: mathematics and mathematics education. The mathematics content of these courses included numbers, algebra, geometry, measurement, and data. Meanwhile, the content of the course on mathematics education was to develop learning instruction on teaching mathematics for lower primary school grades.

Task

The tasks comprise two types of problems: mathematics and didactics. The mathematical tasks focus on assessing prospective mathematical knowledge of rational numbers. The didactic tasks aim to evaluate the prospective construction of contextual problems posed by rational numbers. There are eight mathematical tasks and two didactic tasks. The mathematical tasks cover two mathematics domains, namely the structure and operations of rational numbers. Each task requires prospective teachers to complete the task and to provide their mathematical reasoning behind it.

The mathematical tasks about the structure of rational numbers consist of four tasks: positioning a fraction on a number line, structuring the set of rational numbers, and comparing fractions and equivalent fractions. The tasks of positioning a fraction on a number line and equivalent fractions are presented using figures, and the task of comparing fractions is presented using a real-life context. Figure 1 illustrates the mathematical task of positioning a fraction on a number line (Figure 1).

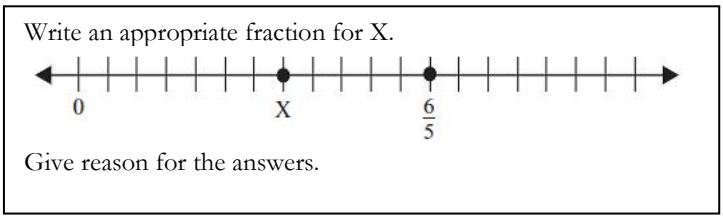

Figure 1. A mathematical task of positioning a fraction on a number line

The mathematical tasks about operations of rational numbers also consist of four tasks: fraction addition, two fraction division tasks, and a mixed fraction operation. Three tasks are given within real-life contents, and the other task about fraction addition is presented using diagram representation. Figure 2 presents the task of fraction addition.

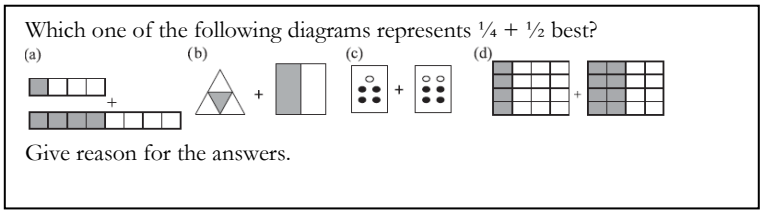

Figure 2. A mathematical task of fraction addition (Li, 2014)

The didactic tasks ask prospective teachers to pose a real-life/contextual situation for a given mathematical operation. For example, the first problem-posing task is fraction multiplication, while the other is about fraction division. We illustrate the task of fraction division in Figure 3.

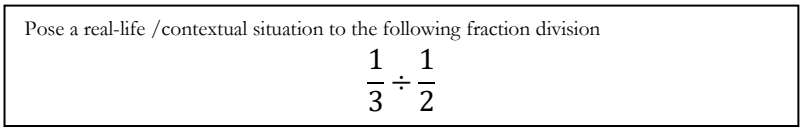

Figure 3. A didactic task of fraction division

The tasks presented in this study are limited, especially the didactic problems, but they are sufficient to accommodate what is in the primary school curriculum for the upper classes (Kemdikbud, 2020).

For instance, student ability to solve problems related to fraction operations becomes one of the core competences for sixth-grade students. They are expected to achieve this goal by the end of the grade.

Procedures and Process

All tasks were presented in a learning management system called Schoology. The participants completed the first test before they had online learning instruction about rational numbers. Then, the participants retook the test a month later to evaluate their understanding of consistency about rational numbers. Between these two tests, the participants attended four meetings, consisting of investigation of rational number concepts from the academic journal (e.g., Castro-Rodríguez et al., 2016; Vamvakoussi and Vosniadou, 2004), designing learning instruction for teaching fractions, and discussion in small groups, as well as online classroom discussion.

Finally, the tasks were assessed by prospective teachers randomly. These tasks aim to avoid cheating on the tests, and the time to complete the tests was 75 minutes.

The three sets of online learning instruction about fractions provided prospective teachers with several learning activities and materials. Before attending the synchronous lectures, prospective teachers were asked to study a module and some scientific articles about fractions. For instance, the main topic for the first meeting was about sub constructs of fractions; therefore, the participants were asked to read two scientific articles about this topic, and one of them was an article written by Charalambous and Pitta-Pantazi (2007) about drawing on a theoretical model to study students' understanding of fractions. Then, the synchronised lectures were conducted using Skype, during which the lecturer and the participants discussed the concept of sub constructs of fractions. In the second meeting, the prospective teachers worked in small groups (3 to 4 participants) to design a learning scenario of fractions for primary school students. The design was then uploaded to Schoology and reviewed by the lecturer. In the next meeting of the synchronised lecture, some groups presented their design learning scenarios and received feedback from the lecturer and other participants.

Prospective teachers' answers for each of the ten tasks were evaluated for correctness. Each answer to mathematical tasks was scored 0, 1, or 2: score 0 for an incorrect answer to both the mathematical problem and its reason, score 1 for a partially correct answer such as a correct answer of the mathematical problem but no reason or incorrect reason, and score 2 for getting both answer and reason correct. Each answer on the didactic tasks was also scored 0, 1 or 2: score 0 for an incorrect answer, score 1 for a partly correct answer such as faulty units or meaningless context, and scoring 2 for an entirely correct answer. The first authors coded all prospective teachers' answers. Coding reliability was checked through additional coding by the third author, who coded a random range of 60% of the answers. The inter-rate reliability of this coding resulted in a value of .82. These findings suggest that the coding was reliable.

Results

The results for prospective teachers' understanding of rational numbers are presented in Figure 4. The prospective teachers have better mathematical than didactic knowledge. Their average score on the first test was less than half the answers correct for mathematical and didactic tasks.

The average score increased on the second test, but it was still less than 75% correct answers. We noticed that prospective teachers had more difficulty with the didactic tasks than with the mathematical tasks. A paired-sample *t*-test revealed that the differences were statistically significantly different between prospective teachers' mathematical and didactic knowledge on the two tests [first test, t (1,37) = 2.305; $p < .05$; and second test, t (1,37) = 3.293; $p < .05$]. Their performance improved significantly on both mathematical [t (1,37) = 7.134; $p < .001$] and didactic tasks [t (1,37) = 3.939; $p < .001$]. Their cumulative performance increased from test 1 (M = .91; SD = .47) to test 2 (M = 1.30; SD = .52), and it was statistically significant [t (1,37) = 5.938; $p < .001$].

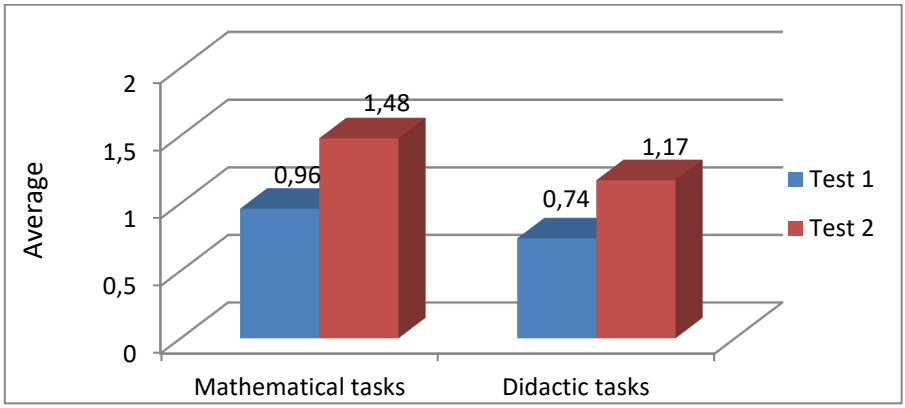

Figure 4. Prospective teachers' average scores on mathematical and didactic tasks

Prospective teachers' performance was moderate on the mathematical tasks concerning the structure of rational numbers (Figure 5). The average score increased by .30 from test 1(M = 1.22; SD = .53) to test 2 (M = 1.52; SD = .56). A paired-sample *t*-test revealed that the difference was statistically significantly different between test 1 and test 2 ($t(1,37) = 4.071$; $p < .001$). We noticed that prospective teachers had more difficulty with the mathematical task of comparing fractions than with the others. However, their performance increased significantly on the mathematical task of positioning a fraction on a number line after participating in four meetings regarding understanding fractions and constructing a learning instruction for teaching fractions to students.

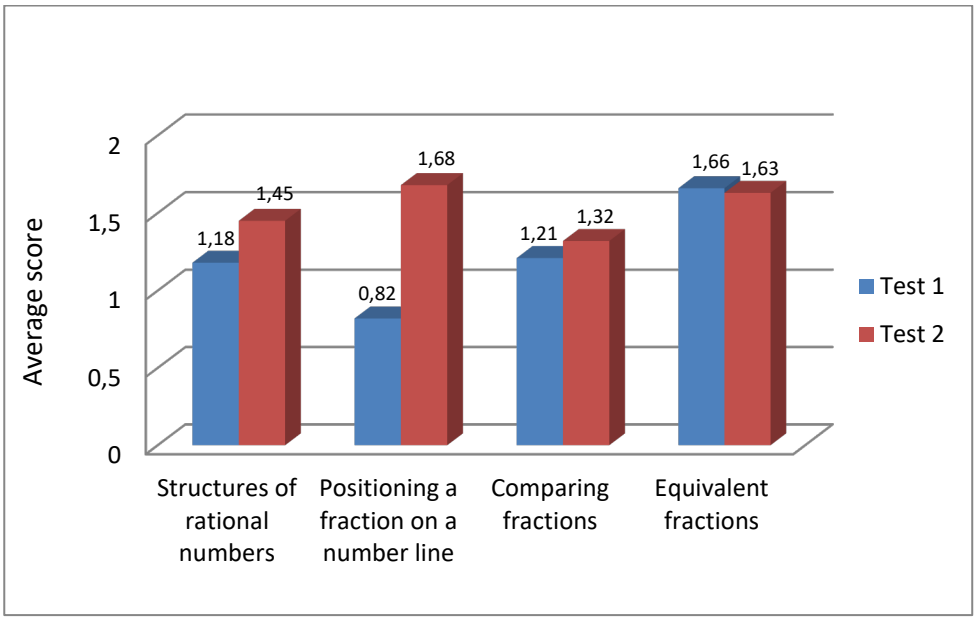

Figure 5. Prospective teachers' average scores on the structure of rational numbers

Among the four mathematical tasks about the structure of rational numbers, positioning a fraction on a number line (Figure 1) was the most challenging task in the first test, where the average score for this task was below 1 point (Figure 5). This score means that many prospective teachers could not find a fraction shown by *X* on a number line. For example, one of the prospective teachers, coded as PST23, answered that *X* was equal to 1/5 because the position of *X* was on the left side of 6/5, so the numerator was getting smaller. She counted the numerator backwards from 6 to 1, from 6/5 to *X*. She did not become aware that the distance between 0 and *X* should be longer than that between *X* and 6/5. However, she completed the same task correctly on test 2. She wrote, "6/5 = 1.2. When we look at the line, 6/5 is in the 12th line, so 12/10 = 1.2. We can also change it to 120% when *X* is in the 7th line, which equals 7/10=0.7. So, *X* equals 7/10 or 0.7 or 70%" (Figure 6). Her answer on test 2 was correct, and she could also give several representations for the same rational number

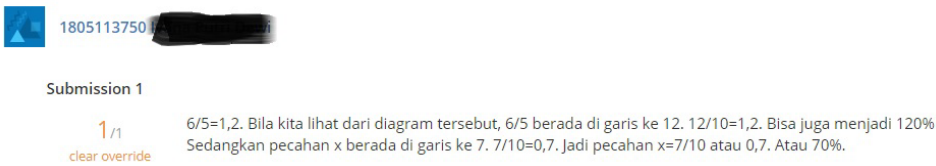

Figure 6. PST23's answer on the second test

Prospective teachers' performance was poor on the operation of fractions on test 1 (M = .70; SD = .49) but significantly increased on test 2 (M = 1.44; SD = .68) (Figure 7). A paired-sample *t*-test revealed that the differences were statistically and significantly different between test 1 and test 2 ($t(1,37) = 7.945$; $p < .001$). We noticed that the prospective teachers had more difficulty with the mathematical task of mixed fraction operation, and their performance significantly increased on fraction addition.

Surprisingly, the prospective teachers performed much better on fraction division than on the other two tasks. To show why this could be the case, we present an example of prospective teachers' answers to the task of fraction addition (Figure 2). To the first test, PST10 answered the correct representation for ¼ + ½ is answer b. She argued, "the shaded area on the triangle shows ¼, which is one shaded part from 4 triangles, and the shaded area of the rectangle shows 1/2, which is one shaded part from 2 rectangles". She was not aware that the two diagrams were in different shapes. However, she could give a correct answer on the second test. She answered that the correct representation for ¼ + ½ was D because ¼ is half of ½, and the two fractions were represented in the same shapes. So, diagram D represents a fraction of 4/16 equals ¼ and a fraction of 8/6 equals ½. This answer indicated that she was aware of the need for the same diagram to represent adding two fractions.

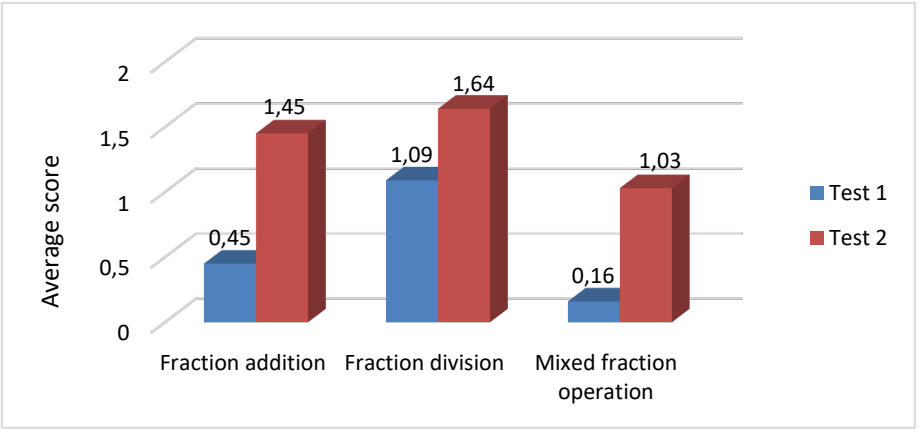

Figure 7. Prospective teachers' average scores on the operation of rational numbers

The prospective teachers were found to perform poorly on didactic tasks (Figure 8). The average score increased by 34 from test 1(M = .74; SD = .73) to test 2 (M = 1.17; SD = .74). A paired-samples T-test revealed that the differences were statistically significantly different between test 1 and test 2 ($t(1,37) = 3.939$; $p < .001$). We noticed that the prospective teachers had more difficulty with the didactic task of problem posing on fraction division than on fraction multiplication.

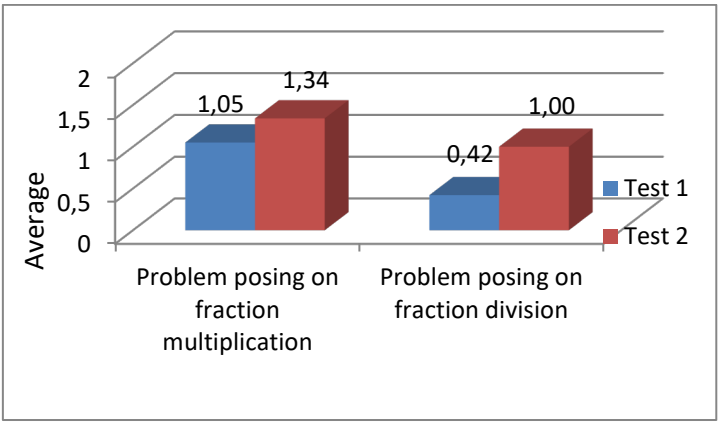

Figure 8. Prospective teachers' average scores on problem-posing tasks

To illustrate the prospective teachers' didactic knowledge of rational numbers, we present an example of one prospective teacher's response to posing a contextual problem on fraction division. PST20 provided an incorrect answer on the first test. She wrote, "Kiki has 1/3 of a brownie. ½ of the brownie will be shared with her sister. How many brownies will her sister get?" (Figure 9). This contextual task represented a task of fraction multiplication instead of fraction division. In the second test, PST20 could give the correct answer. She represented the task using partitive division. She wrote "Dodo has 1/3 kg of rice in his kitchen. Then, the rice is put in a plastic container measuring ½ kg of rice. How much of the container is filled with rice?" (Figure 10). We also found that some prospective teachers, given the correct answers on the second test, represented the division task based on a ratio. For instance, PST18 wrote, "A mother has 1/3 kg of sugar to make a cake. Suppose the cake recipe requires ½ kg of sugar. How many cakes can she make?" (Figure 11).

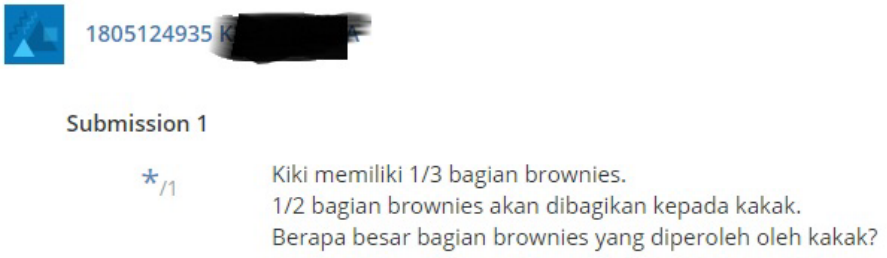

Figure 9. PST20's answer on the first test of the fraction division task

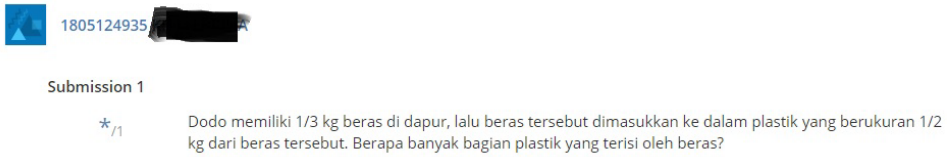

Figure 10. PST20's answer on the second test of the fraction division task

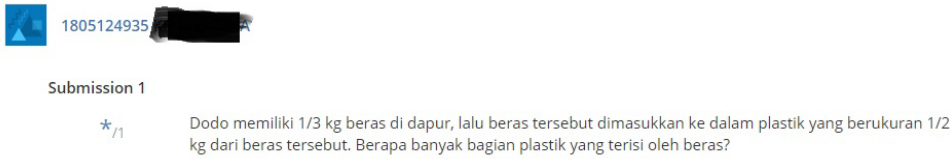

Figure 11. PST18's answer on the second test of the fraction division task

Discussion

This study sought to investigate prospective primary teachers' understanding of rational numbers through a formative online assessment. The study focuses on their mathematical and didactic knowledge of rational numbers. The results indicate that prospective teachers improved their mathematical and didactic knowledge of rational numbers during the study.

Concerning mathematical knowledge, the mean score was only half the answers correct on the first test and three-quarters of the answers correct on the second test, even after they had received instruction on the structure and operation of rational numbers. This finding is in line with the study conducted by Depaepe et al. (2015). They found that prospective teachers have limited mathematical knowledge even though they have received instruction on rational numbers during their training. Therefore, it is suggested that the mathematical content of the course should emphasize conceptual and procedural knowledge of rational numbers. Meanwhile, prospective teachers' difficulty with rational numbers could be caused by their understanding of the structure and the operation of rational numbers (Siegler and Lortie-Forgues, 2017). Some prospective teachers know only a single meaning of rational numbers, a part-whole relationship (Putra, 2018). However, this understanding is insufficient to deal with different task types involving rational numbers. For instance, less than half the prospective teachers could place a fraction on a correct number line in the first test because many of them understood a fraction only as part of a whole.

Prospective teachers' didactic knowledge of rational numbers was much more limited than their mathematical knowledge. Although they did improve their performance on the second test, the mean score was just slightly above half the answers correct. This finding is similar to previous studies on teachers' didactic knowledge of rational numbers (Depaepe et al., 2015; Izsák, 2008; Lo and Luo, 2012; Putra, 2019b). Lo and Luo (2012) also found that prospective primary teachers, who are highly proficient at primary and middle school mathematics, have similar challenges with representing fraction division using word problems or pictorial diagrams, which is also the case for this study. Only half the prospective teachers in the second test could construct an appropriate contextual or actual word situation for the division task. Prospective teachers' limited mathematical knowledge could be caused by their limited classroom experience (Depaepe et al., 2015).

As we know, this study's participants were second-year students who lacked classroom experience, especially in teaching rational numbers. However, a previous study conducted by Putra (2018) revealed that final-year prospective teachers also had insufficient mathematical and didactic knowledge of rational numbers. They had received some classroom experience, but this did not guarantee that they had acquired better didactic knowledge. Therefore, training in teaching institutions should undoubtedly address the topic of transforming a mathematical notation or model into a contextual or word problem, and vice versa. The pedagogical quality of teachers' work and student progress is determined by their mathematical and didactic knowledge (Hill et al., 2005). The gaps in prospective teachers' mathematical and didactic knowledge of rational numbers become a challenge for improving teaching quality in primary school. As revealed by this study, many prospective teachers struggled with didactic tasks more than with mathematical tasks. The difference between the two knowledge constructs is statistically significant. Although this study did not examine the relationship between prospective teachers' mathematical and didactic knowledge, some previous studies have revealed that the construction of teachers' didactic knowledge has a significantly positive relationship with their mathematical knowledge (Depaepe et al., 2015; Tirosh, 2000). Therefore, prospective teachers should have sufficient mathematical knowledge for them to develop their didactic knowledge of rational numbers (Depaepe et al., 2015). However, didactic knowledge is much more complex than just mathematical knowledge because teachers need more than just sufficient mathematical knowledge, but also other knowledge, such as pedagogical and technological knowledge, as well as knowledge of students and contexts.

Conclusion

The prospective teachers have insufficient knowledge of rational numbers. Although their knowledge is much better on mathematical tasks than on didactic ones, they still could not achieve a mean score above three-quarters of answers correct on the second test; this is the minimum score for professional teachers in Indonesia (Kemdikbudristek, 2021). These prospective teachers' mathematical knowledge significantly increased in positioning a fraction on a number line and in fraction addition.

These two tasks were not the most difficult, but a lack of conceptual understanding of rational numbers led prospective teachers to incorrect answers and reasoning.

The prospective teachers clearly struggled with didactic tasks, especially in constructing a contextual or real-life situation involving fraction division. Only half the participants could deal with that task. Their difficulty was interpreting the symbolic meaning of division in a real-world situation.

The online formative assessment used in this study revealed a change in prospective teachers' performance on the tests. Their mathematical and didactic knowledge significantly increased on the second test because, between the two tests, they received online intervention on understanding rational number concepts, constructing instructional learning, and online discussion. Familiarity with the use of digital technology during the course and the intervention helped them in adjusting to the process of online formative assessment conducted in this course, especially as an effect of the COVID-19 pandemic. However, we recognise some limitations of this study. First, the problems on the two tests are the same, and that could lie behind the participant' precise performance on the second test. During the intervention, they could discuss the tasks with their peers. We suggest giving different mathematical and didactic tasks for the first and second tests for further study. Second, there were more mathematical tasks than didactic tasks. The limited number of didactic tasks could affect the results for prospective teachers' didactic knowledge. It could be different if the didactic tasks covered both the structure and operation of rational numbers. Lastly, this study was conducted in a class at a teaching institution. A further study needs to consider a control class for assessing the effectiveness of the intervention and the online formative assessment.

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THE PICTURE BOOK AND ITS ROLE IN PRESCHOOL MATHEMATICS EDUCATION

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Abstract/Izvleček

The paper examines the role of the picture book as a learning resource in preschool mathematics education and illustrates the possibilities for its application. The paper aims to examine whether preschool teachers use picture books in preschool mathematics education, what areas of mathematics they most use these for, and whether they recognize methodological advantages to their application. Results show that half of preschool teachers use the picture book as a teaching resource in preschool mathematics education, that it is mostly used to develop the concept of natural numbers and spatial relations, as well as that teachers clearly perceive methodological advantages.

Keywords:
child, picture book, preschool mathematics education, preschool teacher, speech development.

Slikanica in njena vloga v predšolskem matematičnem izobraževanju

V članku obravnavamo vlogo slikanice kot učnega vira pri učenju in poučevanju matematike v predšolskem obdobju ter predstavimo možnosti njene uporabe. Osnovni namen je ugotoviti, ali učitelji predšolske vzgoje uporabljajo slikanice pri poučevanju matematike na predšolski stopnji, za katera področja matematike jih najpogosteje uporabljajo in ali prepoznavajo metodološke prednosti njihove rabe. Rezultati kažejo, da polovica učiteljev predšolske vzgoje slikanico uporablja kot učno sredstvo pri poučevanju matematike v predšolskem obdobju, da jo najpogosteje uporabljajo za razvijanje pojma naravnih števil in prostorskih odnosov ter da prepoznavajo metodološke prednosti njene uporabe.

Ključne besede:
otrok, slikanica, poučevanje matematike v predšolskem obdobju, učitelj predšolske vzgoje, govorni razvoj

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Introduction

Picture books "present the first literary content to children they are given to, and the first books that mark their childhood and growing up" (Maričić et al., 2018b, 634). Perusing a picture book is pure enjoyment for a preschool child, but it is also play through which they spontaneously learn, and play is "a medium that allows imaginative transformation of the child's observation and understanding of immediate reality" (Šagud and Petrović Sočo, 2014, 279). The crucial role in making a decision to "hang around" books is played by the illustration (picture) which depicts a phenomenon the child finds interesting. This is why the picture book is defined as a book that combines at least two codes: "linguistic (text) and visual (illustration), whereby the text is usually sparser than the visual element, and (generally) does not exceed 1800 characters" (Batić and Haramija, 2019, 246).
The methodological literature points out the importance of picture books in preschool learning, especially when it comes to the development of abstract thinking and acquisition of symbols (Petrović, 2014, 112). The role of picture books is especially evident in all activities aimed at speech and language development, vocabulary enrichment, and formation of reading habits. However, the possibilities of the picture book as a useful technique in preschool education are by no means exhausted here. This paper aims to explore and point out the contribution and value of the picture book in preschool mathematics and examine its application in practice.

Picture books' didactic potential for preschool mathematics

Preschool mathematics education is characterized by a variety of unique properties. It is a period of mathematics education when the child should develop the first mathematical concepts and ideas, on the one hand, while on the other, facing various restrictions due to insufficiently developed logical and mathematical thinking. At this stage of development, the child's life experience and their environment are the starting points, or the bases for building the basic mathematical concepts, i.e., "children 'build' them using objects, items and phenomena from the real world, bringing them into symbolic correlations by means of symbolic structures, such as speech and other written symbols" (Marendić, 2009, 135).

Developing abstract thinking is possible "only if the requirements for adequate previous sensory experiences are met" (Kopas-Vukašinović, and Stojanović, 2012, 170); hence, the teacher needs "to choose adequate and suitable examples, and nurture intuition in concept building" (Đokić and Trmčić, 2012, 184). Mathematical concepts at preschool age "cannot be learned from definition" (Đokić and Trmčić, 2012, 184).

Mathematical knowledge is woven into the very fabric of our world, and among preschool children, its acquisition must be entirely devoid of abstraction. In this context, the authors emphasise the content of children's literature, because it is familiar and relatable to children, and can, therefore, play an intermediary role in learning mathematical concepts, because "children's literature reveals mathematics in authentic settings that has meaning to children" (Bragg et al., 2013, 13).

In children's literature, the picture book occupies a special place as a resource that can be used in preschool mathematics education. In fact, various research papers indicate the potential and importance arising from the application of picture books in preschool mathematics (O'Neill et al., 2004; Tucker et al., 2010; Van den Heuvel-Panhuizen, and Elia, 2012). These authors emphasize that the picture book "can offer a meaningful context for learning mathematics and provide an informal basis of experience with mathematical ideas that can be a springboard for more formal levels of understanding" (Van den Heuvel-Panhuizen et al., 2009, 37) and "can support children in attaching personal meaning to the mathematical objects involved in the books" (Van den Heuvel-Panhuizen et al., 2016, 324). These books provide children with a context to explore mathematics in a way that is relatable and relevant to their personal life (Tucker et al., 2010), as well as to improve mathematical achievement (Van den Heuvel-Panhuizen et al., 2014). They provide children with a context that allows them to learn and explore mathematics in a way that is relatable to their personal lives (Tucker et al., 2010), and motivates them to work (Can et al., 2020). In addition, research results show that the picture book "as a whole has the potential for cognitively engaging children" (Elia et al., 2010, 275).

Reading picture books can help children learn mathematics, because learning takes place in a context that is meaningful, relatable and close to their interests and preferences in life. While flipping through a picture book, the child can follow the narrative depicted through illustrations with help from the teacher or the parents, while spontaneously and unobtrusively noticing mathematical concepts that are not specifically spelled out in the narrative segment.

Picture books have "a place in math education because they often verbalize the concepts that students have difficulty understanding and show these concepts visually" (McDonald and Rasch, 2004, 9). In this context, a picture book and its content, which is represented through pictures, represent a visual code which leads to the development of a mathematical concept. The process of developing mathematical concepts is based on this code. Each mathematical concept being formed at an early age must be based on a precise visual code by means of which a certain mathematical concept is represented in an obvious way. As pointed out by Van den Heuvel-Panhuizen et al., picture books are particularly suitable because "through reading picture books, children encounter novel images or actions that linger in their minds, which they can combine with previous experiences, and on which they can build new thoughts and understandings" (Van den Heuvel-Panhuizen et al., 2009, 30-31). Preschool children do not have the capacity for abstract visualization, which they always relate to concrete items or visual representations, and in the case of picture books, it is always related to children's spontaneous activity of leafing through a picture book and enjoying a relatable and interesting learning environment. These are the reasons why Lovitt and Clarke (1992) regard picture books as "cognitive hooks" for learning mathematics.

Picture books "can be regarded as a community agent conveying culturally developed mathematical meanings" (Van den Heuvel-Panhuizen and Elia, 2013, 228). In this way, the formal way of learning mathematics becomes redundant, because mathematics "settles" on the pages of the picture book. With the teacher's guidance, the child notices elements in the pictures, their relationships, quantitative properties, as well as mathematical properties in the context of the picture book, thus acquiring mathematical concepts. Learning mathematics is placed in the context of the child's interest, outside the traditional learning pattern, so children learn mathematics in a meaningful context of the story from the picture book (Columba et al., 2005). "The use of picture books in mathematics teaching gives children the opportunity to construct their learning (using similar processes as those of scientists), by attaching personal meaning to the mathematical objects involved in the books and thereby gain a mathematical understanding" (Van den Heuvel-Panhuizen and Elia, 2013, 228).

The extent to which the picture book will play a role in mathematical learning depends primarily on the choice of picture book. When choosing a picture book, one must take multiple aspects into consideration, because they can influence what the children will focus on, given that "children are selective in their learning and . . . properties of media can affect children's learning" (Strouse et al., 2018, 2). Preschool teachers must make sure that the content of the picture book matches children's interests and preferences, which vary depending on their age. The crucial element is the knowledge of integration, given that preschool mathematics education is linked to children's literature, and that mathematical knowledge and speech development are developed simultaneously.

Using picture books in preschool mathematics education

We will show how the picture book can be used in the process of developing mathematical concepts in preschool education, using concrete examples. The picture books in question were not designed specifically for learning mathematics. Studies show that picture books, even those that have not been created specifically for learning mathematics, can positively influence mathematical thinking in children, provided that they possess literary quality (Van den Heuvel-Panhuizen et al., 2016). For example, a picture book based on motifs from the famous fairy tale "Little Red Riding Hood" can be used to help children form a mental image of the concept of numbers, specifically the number ONE. Flipping through the pages of this picture book, the child notices the main characters of this fairy tale (Red Riding Hood, Grandma, the Wolf, etc.) (*Crvenkapa,* 2010).

Based on the context in this picture book, the entire depiction is an illustration in a picture book placed in a real context, and unit sets are formed, in other words, by using examples (one wolf, one girl, one woodcutter, one grandma), and the child arrives at an abstract concept, i.e. a mental image of the concept of the number ONE. The procedure described above allows children to be "introduced to the process of observing and identifying unit sets in their surroundings" (Maričić et al., 2018a, 406).

The picture book *Snow White and the Seven Dwarfs* can be a good basis for forming the concept of the number 7. The arrangement of the dwarfs on the pages of the book vaires, and this constitutes a good basis for understanding the concept of the number 7, as the child notes the group of dwarfs.

On one page, they stand in a line, which makes them easily identifiable, whereas on another page, they aregrouped with other characters; in the latter case, identifying the set of seven dwarfs becomes a more complex cognitive challenge for the child (*Snow White and the Seven Dwarfs,* 1998). Other elements featured in the illustrations for this picture book are a starting point for identifying other sets (an animal set, a set comprising Snow White and the Prince, a set of dwarf hats), knowing their cardinal numbers, and comparing numbers.

Other picture books based on well-known fairy tales can be similarly used, *The Three Little Pigs* for example (developing the concept of the number 3), or *Goldilocks and the Three Bears* (developing the concept of the numbers 3 and 4). Thanks to these examples, the child begins to view and understand numbers as quantitative properties, i.e., as a quantity of objects, instead of an abstraction, especially if we keep in mind that "the concept of numbers represents a great abstraction for children" (Maričić et al., 2018a, 405).

The picture book *The Smurf's Song* is a good starting point for developing spatial orientation, using the examples of left/right and in front of/between/behind relations (Peyo, 2009, 15–16). On the pages of the picture book, the main character, the Smurf appears in a forest environment. In the illustration, he is standing on a stone, surrounded by animals (squirrels, bears, birds, bunny, butterfly, fawn, and snails) and trees. The Smurf becomes a reference point with regard to which spatial relations are defined. Such exercises in visual perception are important in preschool mathematics, because research results have confirmed that "as growth in visual-spatial skills emerges, so does growth in math performance" (Murphy et al., 2007, 473). The teacher can use the content of such a picture book to help children form the concept of a set, and compare sets, e.g. sets of different animals (a set of squirrels; a set of birds; a set of rabbits; a set of snails), a set of Smurfs, etc.

In the picture book *Puppy*, the animal protagonist implores the child: "My favorite toy is a ball. Please, help me find it!" (Mlinarek, 2005, 4). On the page of the picture book, the animal protagonist is shown in an environment to which a child can easily relate: a room occupied by various toys, most of which are geometric shapes (a sphere, a parallelepiped, a cube, a cylinder etc.). So, the child receives a task directly from the hero of the story (puppy), thus becoming a hero himself/herself, because they need to help the puppy by identifying the ball among a range of shapes.

The teacher can expand the task by talking about other shapes that appear in the illustrations in the picture book, and in particular, by noticing and naming the differences between geometric shapes and objects.

These examples illustrate some possibilities for using picture books in preschool mathematics, and the value of this approach is evidenced by research results. In this type of learning, the child learns mathematics in the context of pictures, associating them with relatable situations from their environment, and thus creates strong links between mathematics and the context, which is crucial in preschool mathematics education. A picture book "can stimulate mathematical discussion, introduce and develop abstract concepts, and lead into relevant and interesting mathematical activities" (Jenkins, 2010, 28).

The importance of the picture book is increasingly recognized by teachers, especially "that storybook reading can be a valuable context for learning and teaching mathematics" (Anderson et al., 2004, 5). In this paper, we sought answers directly from preschool teachers' practice regarding the use of picture books in preschool mathematics education. The research aimed to discover whether preschool teachers use picture books in their practice to develop elementary mathematical concepts, what areas of preschool mathematics are most suitable for the application of the picture book, and what methodological advantages of picture books are positively evaluated.

Methodological Framework

In this paper, we sought answers from in-service preschool teachers regarding the use of picture books in preschool mathematics education. The research aimed to determine the following: 1) whether preschool teachers use picture books in developing early mathematical concepts; 2) which areas of preschool mathematics education are most suitable for the application of picture books; and 3) which methodological advantages of picture books they evaluate positively.

The research was conducted in 2021, on a sample of 624 preschool teachers/educators working in kindergartens in Serbia. All participants took part in the first research task and answered the given question, whereas only those preschool teachers stating that they used picture books in their teaching practice provided opinions and attitudes directly related to the application of picture books and assessed the methodological benefits.

Regarding the question whether they use picture books in developing early mathematical concepts, half the preschool teachers (312 or 50%) stated that they used picture books as a resource in early mathematics education. Accordingly, the research sample was reduced to 312 participants.

The research utilized a descriptive method and theoretical analysis. A questionnaire containing close-ended questions and a Likert-type scale was constructed for the purposes of this research. The survey was anonymous to ensure impartiality of the respondents' answers. The questionnaire provided data on whether preschool teachers use picture books in the activities aimed at developing basic mathematical concepts, and the data on the elements of preschool mathematics education were developed through the use of picture books. The Likert-type scale was used to determine how preschool teachers assess the benefits of picture books in preschool mathematics education. The value of Cronbach's alpha of the questionnaire (α = 0,79) and the Likert scale of attitudes (α = 0,82) indicate good reliability and good internal consistency of the measuring instruments. The collected data were processed by qualitative analysis.

Research Results and Discussion

The results show that half the respondents, 312 or 50%, use picture books as a learning resurce in early childhood mathematics education, while the other half does not. Although the result revealing that half the preschool teachers do not use picture books in developing early mathematical concepts is not negative in itself, it does suggest the need to explore the reasons why they do not use picture books.

We wanted to determine how preschool teachers assess the contribution of the picture book as a learning resource in mastering various concepts of preschool mathematics education. Respondents were given the task of ranking mathematical concepts by the extent to which the picture book can help develop these, from 1 (most) to 5 (least). The obtained data show that the respondents believe that the picture book is most useful in the development of the concept of *natural numbers* (M = 1.51), *spatial relations* (M=2.62), and the concept of *sets* (M = 2.72) (Table 1). It is notable that they place less value on the influence of the picture book when it comes to developing the concept of *measurements* (M = 3.77), whereas its contribution to the development of *geometry* concepts is ranked the lowest (M = 4.33).

Table 1: Efficiency of the picture book at helping children master mathematical concepts

Concepts in preschool mathematics education	M	SD
Sets	2.72	1.11
Numbers	1.51	.88
Geometry	4.33	.99
Measurements	3.77	1.11
Spatial relations	2.62	1.08

Such a positive assessment of the picture book's contribution to the development of the *concept of numbers* and spatial relations is understandable, because examples, i.e., situations that enable observing and identifying sets, as well as forming equivalent sets, and which represent the basis for developing the concept of numbers, are common in picture books. Likewise, spatial relations can be observed in almost every illustration by observing the relations between the elements depicted. Through such illustrations, the content of the picture book creates a realistic basis for such observations. In addition, picture books greatly facilitate the work of educators in terms of preparing learning content and providing a realistic background and the visual representations needed to develop basic mathematical concepts. It is important for us that preschool teachers recognize the role of the picture book in this process, and keep in mind that it has the potential to encourage children's thinking, because "the story provides the children with a meaningful context in which numbers play a role" (Van den Heuvel-Panhuizen and Boogaard, 2008, 352). Björklund and Palmér point out that children tend to focus on numbers related to their "cognitive, meta-cognitive, and affective factors that are present in any situation where a child encounters numbers or numerical relations" (2020, 4). Results of their research show that different forms of numerical reasoning arise while reading picture books, but that children often need the teacher's support to provide the story-driven content with a mathematical meaning (Björklund and Palmér, 2020). The explanation for the frequent use of the picture book to develop the concept of numbers lies in the fact that the concept of numbers and sets is highly abstract for preschool children, and they need a realistic content to be able to understand it, and picture books enable experiential learning (Jenkins, 2010). When it comes to developing the concept of sets, the main advantage of the picture book is that it contains realistic situations that provide a context for observing and identifying concrete examples of "natural" sets, and it is much easier to move from there to the level of abstraction with the support of teachers (Maričić & Purić, 2008, 213).

It is to be expected that the contribution of picture books to the development of geometry concepts and measurements is ranked the lowest by preschool teachers, given that the immediate reality is the main source for their learning, although there are examples in the literature claiming that the integration of literature with measurements has been applied to improve the concept of length among kindergarten children (Van den Heuvel-Panhuizen and Iliada, 2011). Storytelling context has a positive effect on learning geometry (Caseya et. al., 2008), while research results confirm that the picture book can provide a valuable experience and encourage mathematical thinking in this area (Skoumpourdi and Mpakopoulou, 2011).

The research also aimed to determine how preschool teachers assess the methodological advantages of the picture book in preschool mathematics education. The five-point Likert scale shows preschool teachers' agreement or disagreement with the methodological advantages of the picture book (see Table 2).

Table 2: Methodological advantages of the picture book in preschool mathematics education

Statement	M	SD
Picture books contribute to the acquisition of new knowledge of mathematics	1.46	.51
Picture books contribute to vocabulary enrichment and development of language skills	1.43	.63
Illustrations in the book distract the child from learning mathematics	2.34	1.07
Picture books encourage the desire to process what is experienced through different forms of expression	1.20	.49
Picture books create a realistic context for learning mathematics	1.18	.41
Picture books contribute to the development of attention, perception, memory, thinking and reasoning	1.15	.38
Picture books allow children to place abstract concepts in a familiar environment	1.61	.85
Learning mathematics through picture books helps in the formation of positive attitudes toward mathematics	1.25	.48

The results show the statement that picture books contribute to the development of *attention, perception, memory, thinking and reasoning* being ranked highest by preschool teachers (M = 1.15). Considering that these processes are also crucial to the process of learning mathematics, the contribution of the picture book in the development of logical-mathematical thinking is undisputable.

Undoubtedly, by giving this statement the highest ranking, preschool teachers demonstrated that they observed the picture book in the broadest sense of the word and recognize its value in overall child development.

The second-ranked statement is that *picture books create a realistic context for learning mathematics* (M = 1.18). This attitude among preschool teachers confirms the main idea of this paper and the attitudes of numerous authors who consider the picture book an important resource for learning mathematics, primarily because it creates a realistic, familiar and relatable learning context for the child (Columba et al., 2005; Maričić et al., 2018a; Maričić, et al., 2018b; Tucker et al., 2010). The next methodological advantage of the picture book appears in the statement that *picture books encourages the desire to process what is experienced through different forms of expression* (M = 1.20). It shows that educators are aware of the importance of internal motivation as the basis of learning at preschool age, which makes perfect sense. The content of the picture book is familiar and relatable to the child. The basic form of expression is a picture that encourages children to be active, inspires them to consider all elements of the situation represented in the picture, to notice relationships, to predict further actions, etc. The key role of preschool teachers here is to channel that process in the right direction, i.e., toward identifying elements that lead to the development of a certain mathematical concept. Such a high ranking of these statements confirms the attitude that teachers within "the early childhood education and mathematics education communities have increasingly recognized the potential for using storybooks and picture books to aid in children's mathematics learning" (Flevares and Schiff, 2014, 1).

The fourth-ranked statement is that *learning mathematics through picture books helps in the formation of positive attitudes toward mathematics* (M = 1.25). Children's literature mediates between the child and the language code of a mathematical concept, because it helps relate personal experience to mathematical ideas (Murphy, 2000); so, the ranking of this statement shows that preschool teachers acknowledge the motivational role of the picture book as a learning resource in preschool mathematics education. The fifth-ranked statement is that *picture books contribute to vocabulary enrichment and development of language skills* (M=1.43). Although this statement refers to one of the primary functions of the picture book, its ranking shows that respondents were primarily focused on the role of the picture book in preschool mathematics education. The statements that *picture books contribute to the acquisition of new knowledge of mathematics* (M = 1.46) and that *picture books allow children to place abstract concepts in a familiar environment* (M = 1.61) received a lower ranking.

This result makes sense, given that the approach to learning mathematics should primarily be based on practical activities, and picture books provide an iconic learning environment. However, looking at the previous attitudes, it is obvious that the picture book is an important resource in preschool mathematics education. It is interesting that the statement that *illustrations in the book distract children from learning mathematics* (M = 2.4) was ranked very low, which once again confirms the value of picture books. Results from previous research confirm the positive effects of pictures on spontaneous mathematical cognition among children (Elia et al., 2010), so it is encouraging that preschool teachers are aware of the importance of illustrations as the picture book's visual code in preschool mathematics education.

Conclusion

A picture book – the very first book in a child's life. Leafing through it, the child plays, but at the same time, learns about the world, explores, discovers and learns. The aim of this paper was to draw attention to the picture book as a resource in the acquisition of initial mathematical knowledge, as well as in the learning and development of basic mathematical concepts, given that the results of previous research show its importance in this process. We conducted research to determine whether preschool teachers use picture books in their practice to develop basic mathematical concepts, and how they assess the role of these books and the methodological advantages in that process. The results show that half the preschool teachers use picture books and that they clearly recognize the methodological advantages of the picture book in preschool mathematics education, and its role, primarily in developing the concept of natural numbers, spatial relations and the concept of sets.

The analysis of preschool teachers' attitudes shows that the methodological advantages of picture books in developing *perception, attention, memory, thinking and reasoning* are most positively evaluated, whereas the advantage that *picture books contribute to vocabulary enrichment and development of language skills* is less positively evaluated than the previous one. This indicates that the respondents were primarily focused on the role of picture books in preschool mathematics education, though it may also be an indicator of segmentation and lack of correlation among different areas in preschool education, namely, speech development and mathematics, and a picture book is precisely the tool that connects them.

Therefore, one of the implications for future research involves determining to what extent preschool teachers are able to connect these two areas in their work.

One weakness of the present study is that it considered neither the reasons why preschool teachers omit picture books in early childhood mathematics education nor the extent to which preschool teachers are trained to use picture books for this purpose, as it may also be one of the reasons why half the preschool teachers do not use picture books. This is why we suggest future research should consider these questions, since both pre-service and in-service preschool teachers should be provided with necessary training and experience in using "children's books as an effective tool to support conceptual understanding in the mathematics teaching process" (Can et al, 2020, 99). Future research should also examine whether preschool teachers need additional education regarding this question and whether university educational programs readily accept innovations in science. The literature also stresses the importance of the need for teacher education programs to be interdisciplinary, in order to find "ways to provide literature-based mathematics experiences" (Wilburne and Napoli, 2008, 7).

It should be noted that mathematical knowledge, although highlighted in the content of the picture book, is not explicitly conveyed to children. The role of the teacher is fundamental here, i.e., to design and plan the learning process to provide clear instructions for children and guide them toward identifying elements of the picture book that lead to the formation of a mental image of the given mathematical concept. A study by Ward et al. (2017) indicates that even when it comes to mathematical picture books, one should be careful, because illustrations may distract the child toward irrelevant features. This fact implies, on the one hand, that preschool teachers should be careful when working with picture books, and on the other hand that, if appropriately presented to the child, picture books can lead to a deeper understanding of mathematical concepts and their stabilization. Numerous researchers point out that even picture books with distinctly literary content, in contrast to those focused on learning mathematics, have a role in promoting mathematical thinking among young children even without prompting by the teacher (Van den Heuvel-Panhuizen et al., 2009; Van den Heuvel-Panhuizen et al., 2016).

We must not ignore the fact that pictures "seem to attract children's interest and attention, and due to their exciting and inspiring narrative framework, picture books are often used as pedagogical materials in preschool education" (Björklund and Palmér, 2020, 2).

Therefore, it is necessary to promote the application of picture books in preschool mathematics education. This need is motivated by several factors: children perceive the content of the picture book as reality; children show no resistance toward the picture book as a learning resource in preschool mathematics education, because it has the status of their *first book*; the variety of topics that can be covered through illustrations and text in the picture book allows the integration of mathematical concepts and other areas of knowledge; application of the picture book enables a simultaneous development of the child's vocabulary and enriches their mathematical vocabulary. These results are indicative, as preschool teachers who use picture books clearly recognize the methodological advantages of picture books in preschool mathematics education, while those preschool teachers who do not use picture books should be encouraged to use them in their work with preschool children.

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ATTITUDES OF SECONDARY SCHOOL STUDENTS TOWARDS TEACHING STYLES BEFORE AND DURING THE COVID–19 PANDEMIC

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Abstract/Izvleček

The aim of this paper was to examine students' attitudes towards teaching styles before and during the COVID-19 pandemic. Mean values were calculated using descriptive statistics, and the T-test for independent samples was used to determine the existence of statistically significant differences between groups. After testing the difference in student assessment of the teachers' style in two different school years, no statistically significant difference was found, potentially owing to student adaptation to the situation. A positive- sign correlation coefficient between the democratic and laissez-faire styles was recorded at a significance level of $p<0.05$.

Keywords:
pedagogical knowledge, pre-service teachers, teacher education, technological knowledge, TPACK

Odnos srednješolcev do stilov učiteljev pred in med pandemijo Covid-19

Namen tega prispevka je bil preučiti stališča učencev do stilov njihovih učiteljev pred in med pandemijo Covid-19. Srednje vrednosti smo izračunali z uporabo deskriptivne statistike, za ugotavljanje obstoja statistično značilnih razlik med skupinami pa smo uporabili t-test za neodvisne vzorce. S testiranjem razlike v oceni učencev o učiteljevem slogu v dveh različnih šolskih letih ni bilo ugotovljene statistično pomembne razlike zaradi morebitne prilagoditve učenca situaciji. Korelacijski koeficient pozitivnega predznaka med demokratičnim in stilom 'laissez-faire' je bil zabeležen na stopnji pomembnosti $p < 0,05$.

Ključne besede:
kakovost poučevanja, spretnosti poučevanja, profesionalni odnos dijak–učitelj, socialna distanca, stres.

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Introduction

In March 2020, owing to the threat of the COVID-19 pandemic, a decision was made to close schools around the world (OECD and World Bank, 2020). According to research (Jokić, Begić et al. (2020), the COVID-19 pandemic caused major changes in the work habits and daily activities of individuals. The teaching process changed completely because it switched to alternative online learning methods (Tonković, Pongračić and Vrsalović, 2020). Although the educational system was prepared for online learning, and the Internet had been accepted as a useful source of information, the new situation led to numerous difficulties. According to (Tonković, Pongračić and Vrsalović, 2020. p. 122), the OECD & World Bank (2020), point out that only 20% of countries affected by the pandemic had the means for online learning because no country had a universal digital curriculum. Teachers offer online classes but often with little success because they are deprived of social contact with students. Among the disadvantages of online classes, students cite frequent misunderstanding of tasks, and the impossibility and unavailability of teacher explanations, which lead to weaker results for students. The teacher's clarification of arising ambiguities in the teaching process and his quick intervention improves cooperation and communication in the class (Runtić and Kevelj, 2020). Jurčević Lozančić and Kudek Mirošević (2021) criticize the positive attitude towards online education, because they emphasize the importance of educators, teachers in this process as creators of a stimulating environment. In the newly created situation, teachers apply different teaching methods to achieve maximum success and maintain student interest in classes. The authors emphasize the importance of the socio-emotional aspect in the learning process, which is necessary to create the sense of comfort that is lost without classroom instruction.

Škutor (2016, p. 703) highlights the teacher as the creator of the socio-emotional aspect of teaching, whose role and style change through this process. Pongračič (2019) emphasizes the importance of communication and strengthening the communication competences that lead teachers to quality teaching. In teaching work (according to Lujić, 2019, p. 130; Breka and Petravić, 2015; Šenjug-Golub, Rajić and Dumančić, 2020), they assign priority to competences and teaching styles. The teacher's style of teaching and classroom management stands out as an important part of a positive classroom climate.

As Škutor (2016, p. 703) points out, all these factors are united by the same purpose: creating better conditions for learning and teaching. According to Waheed, Hussin and Daud, 2018, the teacher's style affects the level of motivation and job satisfaction and creates a pleasant environment in the classroom. Almost all school factors depend on leadership, that is, the styles that teachers adopt and prefer and that influence educational outcomes, he claims (Urick, 2016).

There are numerous definitions of teaching styles, and these are most often associated with the teacher's dominant, specific, and relatively permanent behaviour towards students. A teacher's style guides and directs his way of learning and has a strong effect on students' ability to learn and absorb information (Pongračić, 2019, p. 88). Both authors analyse and categorize teaching styles in a similar way and highlight their characteristics. The first style is the *authoritarian/autocratic style*, characterized by ordering, criticizing, and lack of warmth and feeling, without respect for the child's opinion and individuality. The second style is the *permissive/laissez-faire style*; this is the opposite of the *authoritarian style* and is characterized by warmth and acceptance, but also by the absence of boundaries, and by indulgence because the child is left to himself and to make decisions for which he lacks strength, psychophysical and emotional maturity. The third style is the *authoritative/democratic style,* where the teacher sets boundaries, while respecting the autonomy and individuality of students (Pongračič, 2019, p. 89). Many authors "classify the relationship between students and teachers as personal and professional-social and consider the teacher responsible for the educational success and failure of students" (Dobrotina and Erokhina 2016; Varga, 2015, according to Posavec and Vlah, 2019, p. 58). The teacher is the initiator and motivator of cooperation, appreciation and understanding among students. The teacher-student relationship by its nature is defined as professional-social because it contains a clear goal and intention that presupposes objectivity in these relationships. The opinion of students about the teacher and vice versa are important factors in the quality of the teaching process (Brust Nemet 2018).

Runtić and Kavelj (2020) conducted a survey in Croatia on student opinions about distance learning during the COVID-19 pandemic. The students cited as disadvantages of this type of teaching: too many assigned tasks, difficulty in sharing teaching content, lack of understanding and explanation by individual teachers, and the inability to socialize with friends. They cite interesting and fun classes with the use of digital quizzes as an advantage.

The level of teacher competences, and leadership style are both crucial for distance learning and effective use of information and communication technology. Students expect the teacher to guide, direct, motivate and help them with obstacles. Distance learning can be difficult because of its inaccessibility for students with lower financial status (Huang et al. 2020). Mungroo's (2020) research on student opinions about teachers and their styles suggests adaptive coping strategies and teacher leadership styles that can facilitate the implementation and realization of set teaching goals for the mutual benefit of students and teachers. Carver-Thomas and Darling-Hammond (2017) point out that teachers who work in circumstances that negatively affect their well-being have a negative effect on student achievement. A study conducted in South Africa focusing on education adaptation during COVID-19 (Mhlanga and Moloi, 2020; Mahaye, 2020) contributes to the debate on understanding teacher leadership styles needed during crisis situations. According to these results, their teachers' new online teaching strategies were effective and helped students with teaching and learning challenges and did not significantly affect their academic results. The results of this study show that during the COVID-19 pandemic, only one percent of students showed a slight decline in academic performance. Under such circumstances, Huang et al. (2020), and Runtić and Kavelj (2020, p. 152) emphasize the importance of applying a flexible, student-centred pedagogy that offers a choice of time and place of learning, means for teaching and learning, approaches to teaching, and learning activities, while also offering support for both teachers and students.

The purpose of this paper is to examine student attitudes towards teaching styles before and during the COVID-19 pandemic, in two different school years.

Methodology

Aim and subject of research: The aim of the research was to establish student attitudes about the teaching styles of their teachers before and during the COVID-19 pandemic. The subject of the research is the assessment of the teacher's style from the perspective of high school students before and during the COVID-19 pandemic Research *questions* 1. What are the attitudes of high school students towards the teaching styles of their teachers before and during the COVID-19 pandemic? 2. Do high school students' attitudes towards the teaching styles of their teachers before the COVID-19 pandemic differ by gender? *Participants and research procedure:*

The research sample conducted in the 2018/2019 school year consisted of 400 high school students of both sexes, 148 male and 252 female. The research sample conducted in the 2020/2021 school year consisted of 400 respondents of both sexes, 137 male and 263 female. The study was carried out with the consent of the competent authorities, that is, the principals of the relevant high schools. It is important to point out that the sample consisted only of adult students, more precisely those from the third and fourth years; therefore, the consent of their parents and guardians was not required. The students voluntarily participated in the research, which was anonymous. The first part of the study was conducted in the 2018/2019 school year, and the second part was conducted in 2020/2021, the school year in three Mostar schools with the consent and agreement of the competent persons in the schools. Both studies were carried out during a classroom lesson, and before the study itself, the researcher instructed the participants in how to fill out the given instrument. *Instrument*: For the purposes of the research, an assessment scale was constructed for high school students with the aim of examining their attitudes towards the teachers at the school they attended before and during the COVID-19 pandemic. The measurement instrument consists of 30 variables in the form of statements that treat the characteristics and attitudes of teachers towards students before and during the COVID-19 pandemic. The variables are qualitatively described, and the respondents' answers are quantified according to a Likert-type scale ranging from 1 to 5. (1 = I completely disagree; 2 = I mostly disagree; 3 = I neither agree nor strongly disagree; 4 = mostly agree; 5 = completely agree). The Cronbach alpha of the scale of assessment of teaching styles by students is 0.929, which represents an extremely high internal consistency of the measuring instrument. Statements from the questionnaire were divided into three groups, i.e., the three teacher styles of leading and managing the class and students.

1. Negative attitude towards students and class management style (authoritarian, autocratic style, demanding, criticizing style, without respect for other people's opinions and emotions, negative judgments, uses and emphasizes one's power): 1. The teachers are strict; 2. Teachers give us orders; 3. Teachers punish us (with extra homework, tests, etc.); 4. Teachers criticize us; 5. Teachers emphasize that they have power and behave like bosses; 6. Teachers put pressure on us; 7. Teachers call us derogatory names; 8. Teachers have harsh voices; 9. Teachers sneer or make faces when students say something.

2. Positive qualities of teachers in their leadership style (democratic leadership style, support, guidance, understanding of students): 1. Teachers accept our opinions; 2. The teachers care about my interests; 3. We can turn to teachers for help; 4. Teachers are fair to all students; 5. Teachers point out positive things in students, not just mistakes; 6. Teachers are actively involved in lessons and class activities; 7. Teachers cooperate with us in class; 8. Teachers try their best in class; 9. Teachers praise and encourage us;10. Teachers speak intelligibly; 11. Teachers address us with respect; 12. Teachers use humour in class; 13. Teachers listen to students when they tell them something; 14. The teacher's body language indicates that he is relaxed and open; 15. Teachers look us in the eye when they talk to us; 16. Teachers often smile and are in a good mood in class; 17. Teachers prepare well for class.
3. The teacher's lack of interest in the students (laissez-faire style of class management, avoiding conflicts, permissiveness, class management without goals and rules, without discipline): 1. It is not important for teachers what the students do in class; it is more important for them to hold a lecture on a certain teaching topic; 2. Teachers don't understand; 3. It seems to me that the teachers are not interested in the students or the teaching; 4. With teachers, there are no rules that we have to follow.

Table 1. Representation of respondents by gender in the 2018/2019 and 2020/2021 school year.

Gender	Sample 2018/2019	Sample 2020/2021
Male	148	137
Female	252	263
In total	400	400

Results

The results were first analysed using descriptive statistics with calculation of the mean value. The percentages were calculated, and a tabular presentation was given along with the analysis of percentages of representation. The T-test for independent samples was used to examine the existence of a statistically significant difference between groups. Statistical significance was established at the $p < 0.05$ level.

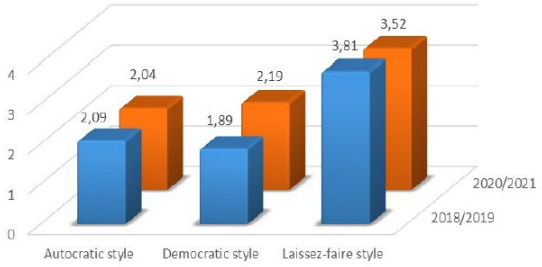
The Statistical Package for the Social Sciences (SPSS) statistical program version 22.0 was used for data processing. Our first task was to investigate and determine how respondents of both sexes evaluated the different teaching styles of their teachers. We performed this task by analysing the research results with the assessment scale, and we presented and clarified these in tables. As part of the same task, we investigated whether there was a statistically significant difference in the assessment by respondents from the 2018/2019 school year and the year 2020/2021 on this issue. We performed that part using the T-test for two independent samples.

Table 2. Student assessment of the styles preferred by teachers in 2018/2019. and 2020/2021

Teaching styles	I completely disagree	I mostly disagree	I neither agree nor disagree	I mostly agree	I completely agree	Arith. mean
Autocratic style 2018/2019	37,13	29,27	23,31	6,10	4,03	2,09
Autocratic style 2020/2021	41,62	26,88	21,04	10,31	3,93	2,04
Laissez-faire style 2018/2019	40,90	38,98	12,65	4,65	2,73	1,89
Laissez-faire style 2020/2021	38,83	26,38	20,375	6,62	7,82	2,19
Democratic style 2018/2019	5,09	6,74	22,92	31,90	33,27	3,81
Democratic style 2020/2021	9,32	11,49	25,47	25,27	28,49	3,52

Table 2 shows the percentage results for student assessment of three teaching styles in research conducted in the 2018/2019 school year and in 2020/2021. The evaluation scale used in the study was constructed in such a way that the answers 'Completely agree' and 'Mostly agree' indicate a high level of the presence of a certain style among teachers. On the other hand, the answers 'Completely disagree' and 'Mostly disagree' express the assessment that teachers rarely or never use this style of leading and managing the class and students, while the answer 'Neither agree nor disagree' expresses indecision among students in relation to the statements. From the results for both school years, it is notable that students have a negative attitude towards the laissez-faire style: 2018/2019, AM =1.89; 2020/2021, AM= 2.19. Respondents also have a slightly negative attitude towards the autoocratic style: 2018/2019 AM = 2.09; 2020/2021, AM = 2.04. Table 2 shows that students have a positive attitude towards the democratic style, as they rated that style highly in both school years: 2018/2019, AM = 3.81; 2020/2021, AM = 3.52. It can be concluded that for students at these schools, the most desirable teaching style is the democratic style, which provides them with the best possible conditions for learning and

teaching. Ahmed, Khan Farooqi and Iqbal (2021) investigated student evaluations of five teaching styles. According to the results, the style of the teacher who is a role model was rated the best, followed by the style of formal authority, then the style of leadership, then the style of delegation, and the worst rated was the professional style. It seems that students want to have a teacher as a role model, while his expertise is less important. Bohren (2019) emphasizes student-centred teaching, where the teacher remains a guide and mentor, providing the student with a sense of freedom and independence. Arithmetic means for student assessment of all three styles of leadership and management of the class and students in the study conducted in the 2018/2019 and 2020/2021 school years are shown in Graph 1.



Graph 1. Comparative presentation of student assessment of teachers' leadership styles

Table 3. Testing the differences in arithmetic means of the evaluation of teacher leadership style before and during the COVID-19 pandemic

School year	N	Arith. mean	t	df	p
2018/2019	400	3.04	1.566	29	0.128
2020/2021	400	2.90			

Looking at Table 3, which tests the difference in the assessment of teacher leadership style by students in two different school years, before and during the COVID-19 pandemic, it is evident that no statistically significant difference was found. The value obtained by examining the arithmetic means t = 1.566 at the level of significance p = 0.128 tells us that there is no statistically significant difference in the assessment of teacher leadership style by students in two different school years. These results were not expected because it was assumed that, given the extraordinary conditions in the teaching process, student evaluation of teachers during the COVID-19 pandemic would be lower compared to the evaluation for the 2018/2019 school year. It is possible that students had adapted to the current situation caused by the COVID-19 pandemic, so this is one reason for the absence of a statistically significant difference before and during the pandemic. Kwatubana and Molaodi (2021), analysing recent literature on the topic of teachers' well-being in crisis situations, point out the two best leadership practices, which are distributed and compassionate leadership. In the following, we sought to examine whether there are statistically significant differences in student assessment of the teacher's leadership style in relation to gender.

Table 4. Testing differences in the arithmetic means of the assessment of teacher leadership style before and during the COVID-19 pandemic by gender

School year	N	Arith. mean	t	p
Male 2018/2019	148	3.037	-0.221	0.826
Female 2018/2019	252	3.048		
Male 2020/2021	137	2.958	1.584	0.124
Female 2020/2021	263	2.863		

Looking at Table 4, which tests the difference in assessments of the teacher's leadership style by students in two separate school years, before and during the COVID-19 pandemic, in relation to gender, there is no statistically significant difference found in either year.

The values obtained by testing arithmetic means amount to t = -0.221 at the level of significance p = 0.826 for the school year 2018/2019 and t = 1.584 at the significance level p = 0.124 for the school year 2020/2021.

These results of the T-test tell us that there is no statistically significant difference in the assessment by students of teacher leadership style in two different school years in relation to gender. These results were not expected, as it was assumed that there would have been major changes in teacher leadership styles before and during the COVID-19 pandemic. Despite the new situation and the negative consequences for the education system, the results indicate the professional attitude of teachers towards their students and the profession. The research participants, 400 high school students, mostly respect and appreciate the efforts of their professors to maintain the quality of teaching. To determine the existence or non-existence of a connection between the leadership and classroom management styles of teachers and student results ad its meaning, we will subject the results to the procedure of establishing correlation and mutual connection. The results of the correlation analysis between the measuring instruments at a level of significance from 0.01 to 0.05 are presented in Table 5.

Table 5. Correlation coefficients for the assessment of teacher leadership styles

	Autocratic style	Democratic style	Laissez-faire style
Autocratic style	1	-0.488*	-0.699**
Democratic style		1	0.728**
Laissez-faire style			1

** Correlation significant at the 0.01 level (two-way).

* Correlation significant at the 0.05 level (two-way).

These correlation coefficients indicate the relationship between teacher leadership styles and leadership styles to determine the existence or non-existence of a relationship and its significance between autocratic, democratic, and laissez-faire leadership styles. Table 5 shows that the observed styles achieve a statistically significant linear correlation of both positive and negative signs at the 0.05 level. The strength of the connection between individual researched areas varies throughout the measurement space. Table 5 shows that the highest correlation coefficient with a positive sign is recorded by the democratic and laissez-faire styles, where the correlation coefficient is $r = 0.728$ at the significance level of $p<0.05$. It is to be expected that these two styles would be highly positively correlated.

The next highest correlation coefficient, with a negative sign, is between the autocratic and laissez-faire styles, where the correlation coefficient is r = -0.699 at the significance level of $p<0.05$; it is again to be expected that the more laissez-faire style would be present in education - the autocratic style is less common in educational institutions. Statistically significant connections of weaker intensity at the $p<0.01$ significance level are recorded between the autocratic and democratic styles, where the correlation coefficient is r = -0.488. Similar results were obtained by Abdur, Roohul and Shabir (2019), where a high correlation was found between different teacher leadership styles and class and student management.

Discussion

According to the results giving student assessment of teachers who prefer the autocratic style in 2018/2019, the arithmetic mean of this teaching style ranges from 1.61 to 2.65. From the student assessment of the quality of teachers who prefer the laissez-faire style in 2018/2019, it is noticeable that the arithmetic mean for this teaching style ranges from 1.68 to 2.10. From the student assessment of the quality of teachers who prefer the democratic style in 2018/2019, it is noticeable that the arithmetic mean for student ratings of this teaching style ranges from 3.11 to 4.27. From all the above, it is evident that teachers in the 2018/2019 school year, according to student evaluation, preferred the democratic style the most, as evident in the percentages for student assessment of the autocratic style of leading and managing the class and students in the research conducted in the 2020/2021 school year. years. it is evident from the results that the arithmetic mean of the student assessment of this teaching style ranges from 1.63 to 2.86. From the presented percentages of student assessment of the laissez-faire style of leading and managing the class and students, it is evident that the arithmetic mean of student assessments of this teaching style ranges from 1.94 to 2.47. From these results on student evaluation of the democratic style of leadership and management of the class and students, it is noticeable that the arithmetic mean for student evaluation of this teaching style ranges from 3.12 to 4.04. Observing the results obtained by testing the difference in the assessment of the teacher's leadership style by students in two separate school years, before and during the COVID-19 pandemic, no statistically significant difference was found.

The value obtained by examining the arithmetic means $t = 1.566$ at the level of significance $p = 0.128$ tells us that there is no statistically significant difference in the assessment of the teacher's leadership style by students in two different school years. The above results of the T-test tell us that there is no statistically significant difference in the evaluation of the teacher's leadership style by the students, even in relation to the gender of the students in two different school years before and during the COVID-19 pandemic. The values obtained by testing arithmetic means amount to $t = -0.221$ at the level of significance $p = 0.826$ for the school year 2018/2019, and $t = 1.584$ at the significance level $p = 0.124$ for the school year 2020/2021. The observed styles achieve a statistically significant linear correlation of both positive and negative signs at the 0.05 level. The strength of the connection between individual researched areas varies across the measurement space. The highest correlation coefficient with a positive sign is recorded for the democratic and laissez-faire styles, where the correlation coefficient is $r = 0.728$ at the significance level of $p<0.05$. It is to be expected that these two styles be highly positively correlated. The next highest correlation coefficient, with a negative sign, occurs between the autocratic and laissez-faire styles, where the correlation coefficient is $r = -0.699$ at the level of significance $p<0.05$, which is again to be expected, since the more the laissez-faire style is present in educational institutions, the less representation there is of the autocratic style. Statistically significant connections of weaker intensity at the $p<0.01$ significance level are recorded between the autocratic and democratic styles, where the correlation coefficient is $r = -0.488$. Research by Carver-Thomas and Darling-Hammond (2017) indicates that the negative effect of crisis situations can be disastrous for the teaching profession because of the continuous effects of stress. Therefore, teachers may permanently leave their profession because they feel unable to respond to new challenges in the teaching process. Owing to the digital transformation of education during the COVID-19 pandemic, Mahaye (2020), Mhlanga and Moloi (2020), and Mungroo (2020) suggest strategies for teachers in the form of self-help to mitigate the negative effect on their way of leading and teaching. In the case of remote teaching, teachers are unsure of their leadership style and therefore need the support and empathy of students and their superiors, as Sokal, Trudel and Babb (2020) point out.

The authors suggest providing appropriate help and support to teachers Berjaoui and Karami-Akkary (2019) point out that compassionate leadership is key in mitigating the effects of stress and emphasize a culture of cooperation among teachers so that the process of distance learning and teaching remains effective and purposeful. This study has both limitations and advantages. First, when conducting the second part of the study, specifically during the COVID-19 pandemic, there was a fear of potential infection. The restrictions also refer to the availability of the participants who made up the sample in the school year before the COVID-19 pandemic. Although classes in Mostar schools at that time took place almost according to the established schedule, there were absences of respondents/high school students because of quarantine. Some professors were also absent because of infection or maternity leave. The change in teachers of certain subjects affected the students' assessment of the teacher's styles, but in general the students could give a realistic assessment of the same. Therefore, this paper makes a modest contribution to research on this topic and leaves room for more extensive research.

Conclusion

This study examined and compared students' attitudes towards the styles of their teachers before and during the COVID-19 pandemic. According to the results, the most common teacher style is the democratic one, followed by the laissez-faire style, and the least represented is the autocratic style. During the final survey, which took place during the COVID-19 pandemic, in the 2020/2021 school year, negative attitudes towards teachers' styles were expected; however, this was not reflected in the results.

Based on the results, it is clear that these teachers engaged in online classes were ready, despite the lack of social contact with students, to respond to challenges and demanding tasks. Through daily activities and tasks, the teaching profession acquires a new dimension and purpose, and the teacher becomes an adaptive and reflective practitioner. The contribution of this paper draws attention to the lack of other research on this issue in Bosnia and Herzegovina and leaves room for future research.

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REVIJA ZA ELEMENTARNO IZOBRAŽEVANJE
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ETIKA UMETNE INTELIGENCE V IZOBRAŽEVANJU

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Izvleček/Abstract

Pokovidno obdobje je razvoj in uporabo umetne inteligence (UI) pospešilo v različnih oblikah in na različne načine. Spremembe se ne dogajajo samo v industriji, temveč je vse večja želja ali zahteva, da se vpelje tudi v izobraževanje. Toda digitalna pismenost vseh deležnikov v izobraževanju mora vključevati zraven vedenja in veščin tudi etiko. V članku predstavimo etične kodekse, povezane z umetno inteligenco, nato analiziramo štiri osnovne gradnike področja etike UI v izobraževanju (avtonomnost, zasebnost, zaupanje in odgovornost), saj je razumevanje konceptov pogoj za delovanje v skladu z njimi in za njihovo uporabo UI v izobraževanju.

Ključne besede:
etika, umetna inteligenca, izobraževanje, kodeksi, odnos

Ethics of Artificial Intelligence in Education

The post-COVID period drastically accelerated the development and increased use of artificial intelligence. These changes have not been limited to industry but have begun to be introduced into education. The digital literacy of all involved in education must also incorporate ethical considerations related to the application of AI in education. The article presents the ethical codes of AI and analyse the four basic building blocks of an ethical attitude towards AI in education (autonomy, privacy, trust and responsibility). Understanding the concepts of AI and their ethical implications is a condition for acting in accordance with them and for their introduction in education.

Keywords:
ethics, artificial intelligence, education, codes, attitude

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Uvod

Individuum, ki ima dostop do informacij, razumevanje, zmožnost ocenitve informacij ter zmožnost delovanja v skladu z oceno, je največkrat v prednosti pred ostalimi člani družbe. V Evropi srednjega veka je latinščina kot lingua franca omogočala eliti in cerkvi pridobivanje in ohranjanje moči, saj so imeli dostop do informacij. V 19. stoletju je tehnološki razvoj in »osvajanje« sveta omogočalo pridobivanje in ohranjanje moči. Posledica globalizacije je, med drugim, tudi vpeljevanje angleščine kot lingue franca sveta, kar pomeni, da je za pridobivanje in ohranjanje moči v sodobnem svetu znanje in razumevanje angleščine nujno. Zavedanje tega se kaže v vpeljavi angleščine kot prvega tujega jezika že v prvo triado osnovne šole. Kaj pa prihodnost? Post-COVID obdobje nam je prineslo razrast umetne inteligence (UI) v vse pore našega življenja, tudi na področje izobraževanja. Zato, če spekuliramo, bodo posamezniki z dostopom do informacij o UI, s poznavanjem delovanja UI, z zmožnostjo ustvarjanja UI, z razumevanjem in zmožnostjo ocenitve teh informacij ter delovanjem v skladu z oceno, v prednosti oziroma bodo nosilci aktivne vloge pri oblikovanju družbe. Raziskava Saliu idr. je pokazala, da skoraj polovica otrok meni, da vedo o tehnologiji več kot njihovi starši; staršev, ki menijo enako, je več kot tretjina. Prav toliko staršev meni "da niso sposobni uporabljati programske opreme, s katero bi zaščitili otroka pred krmarjenjem po njemu škodljivih spletnih straneh". (Saliu H., 2022, str. 158) Preoblikovanje družbe je kompleksni proces, ki se prične pri mladostnikih, ki niso indoktrinirano zavrti in so sposobni sprejemati nove ideje in jih ponotranjiti. Kar stari ne poznajo, starejši gledajo z velikim nezaupanjem in celo strahom, mladina uporablja v vsakdanjem življenju, otroci pa sprejemajo kot dejstvo življenja. Uporabe UI ne bomo mogli odstraniti iz našega življenja, lahko pa jo odpremo in razgalimo že v osnovni šoli in tako ozavestimo otroke na njene prednosti in potencialne slabosti.

V prvem delu članka se tako dotaknemo prednosti vpeljave UI v izobraževanje, v drugem delu predstavimo in problematiziramo osnovna etična vodila, ki nam omilijo zlorabo UI. V tretjem, zadnjem, delu analiziramo in upravičujemo štiri osnovne gradnike, ki bi jih morali nujno ponotranjiti, da bi bila zloraba UI minimalna. Ugotavljamo, da je omenjeno mogoče doseči zgolj z učinkovitim pristopom v izobraževanju.

Umetna inteligenca in izobraževanje

Če sprejmemo opredelitev po OECD, je sistem umetne inteligence zasnovan na strojni opremi, ki omogoča, za nabor prehodno definiranih ciljev, zasnovo napovedi, priporočil ali sprejemanje odločitev z vplivom na realna ali virtualna okolja. Sistemi UI (algoritmi in podatki) so zasnovani z variabilno stopnjo samostojnega delovanja (OECD AI Principles, 2019). Sistem na podlagi UI se ukvarja s simulacijo inteligentnega obnašanja v računalnikih in njihovo zmožnostjo, da posnema in (v idealnih pogojih oz. razmerah) izboljšuje človeško vedenje. Ali je odlika UI izboljševanje človeškega vedenja in lajšanje človeškega delovanja? Glede na zgoraj zapisane zmožnosti vpeljave in uporabe UI v izobraževanju, prav gotovo. Tudi R. Carpenter (Cellan-Jones, 2014) ustvarjalec Cleverbot-a, je v to prepričan, saj meni, da bo človek obdržal kontrolo nad tehnologijo primerno dolgo in da bodo ljudje dojeli potencial UI za reševanje svetovnih problemov.

Apliciranje UI v izobraževanje lahko podpre vse deležnike. Akgun in Greenhow (2022) navajata:

(i) da je UI lahko podpora pri navodilih, pri vodenju skupine z različnimi sposobnostmi;

(ii) osebni sistemi učenja lahko pomagajo učečim, saj nudijo takojšnjo povratno informacijo o pisnih izdelkih, ugotovijo, kje ima učeči primanjkljaj ter mu ponudijo dodatne vsebine za razlago;

(iii) avtomatski sistemi ocenjevanja lahko razbremenijo profesorje, pri čemer ne gre zgolj za preverjanje odgovorov resnično neresnično, temveč so vključena vodila za izboljšanje, za ponovno pisanje (EdX, Gradescope itd.);

(iv) prepoznavanje obrazov, lahko v izobraževanju razumemo kot na učečega osredotočen pedagoški proces (spremljanje obrazne mimike nakazuje padec koncentracije, zmedenost, nerazumevanje; obveščeni učitelj lahko intervenira, popravi razpoloženje in izboljša motivacijo);

(v) napovedna analitika nudi učitelju informacije glede učenčevega »gibanja« ocen oz. podatke, če kje prežijo nevarnosti glede (ne)uspeha učenca ter mu pomaga;

(vi) družbena oz. družabna omrežja lahko povežejo vse deležnike ter tako pospešijo aktivno učenje in pomagajo pri razvoju socialno emocionalnih veščin.

Našteli smo šest primerov, ki vključujejo na učečega osredinjen pouk, motivacijo učitelja, da individualizira pouk ter tako pomaga učečemu, ki potrebuje dodatno motivacijo, dodatno razlago ali pomoč. Ker je razbremenjen nekaterih dejavnosti, ki jih lahko opravi podporni sistem UI, mu tako ostane čas za primarno opravilo. V izobraževanju lahko prilagodi učenje, poveže in ustvari inovativna učna gradiva, izvaja tutorstvo, pomaga učečim s posebnimi potrebami, pomaga učitelju pri ovrednotenju učečih, učečim nudi dostop do učnih vsebin in s pomočjo prevajanja med jeziki premosti jezikovne prepreke (Pesek, Nosović, & Krašna, 2022). Ali omenjeni elementi uporabe UI v izobraževanju predstavljajo kakršnokoli prednost pri dejanskem izvajanju učnega procesa? Kaj je naloga umetne inteligence? Ali je objektivna, nevtralna, nepristranska, poštena, glede na to, da je tehnologija?

Vzemimo primer noža, ostrina je njegova odlika (uporabnost) in hiba (zloraba). Tako je tudi z UI. Znanstveniki in podjetniki svarijo že pred samo človeško zlorabo UI, nekateri pa gredo še dlje. S. Hawking je svaril, da lahko razvoj splošne UI pomeni konec človeštva, saj se bo osamosvojila in samo-preoblikovala. Človeštvo, ki je omejeno s počasno biološko evolucijo temu ne bo moglo več parirat. E. Musk trdi, da večina ljudi nima predstave, kako hitro se razvija in napreduje UI, kar pomeni veliko nevarnost v naslednjih petih, največ desetih letih.

Pa vendar, če je UI še vedno orodje, ki ga ustvarja, kontrolira in uporablja človek in ni nevarnost sama po sebi (Brooks, 2014) (Lanier, 2014), pomeni, da v primeru škodovanja UI človeštvu izhaja dvoje: a.) da potrebujemo omejitve in zamejitve ter vodila tudi za etično uporabo UI in b.) da je potrebno ljudi izobraziti. V nadaljevanju se bomo dotaknili obojega.

Umetna inteligenca, etični kodeksi in smernice

Zgoraj omenjenih šest načinov uporabe UI v izobraževanju je lahko prednost in uspešna uporaba sistema UI v izobraževanju, a zgolj v primeru klinično-sterilnega okolja, kjer je le-ta nevtralen, objektiven, popoln ter predstavlja prednost pred učiteljem, ki je lahko pri odločanju subjektiven in pristranski.

V korist strojnega odločanja se običajno navaja argument, da se s tem iz postopka sprejemanja odločitev izloči predsodke, ki pri človeškem odločanju pomembno vplivajo na rezultat. Toda, iz tega, da je nekaj neodvisno od človeka, nujno ne sledi, da je objektivno in nevtralno, saj »algoritem je dober le toliko, koliko so dobri podatki, ki jih obdeluje, pri čemer lahko predsodke, ki se zrcalijo v zbranih podatkih posvoji do te mere, da postane obstoječi problem še večji« (Bregant, 2020, str. 6).

Izkazalo se je, da sistem UI, ki posamezniku presodi izbiro primernega poklica, odločitve sprejema na podlagi spola, pa tudi rase in regije. (Sijing & Lan, 2018)
Predsodki, ki so zakoreninjeni v nas, vplivajo na (i) razvijanje, oblikovanje in odziv sistemov UI (algoritme), posledično (ii) odzivi sistemov UI vplivajo na njeno (samo-učenje UI) interpretacijo našega sveta, (iii) ponujena interpretacija je v naslednjem koraku sprejeta kot objektivno in nevtralno dejstvo, ki vpliva na (iv) zadnje korake uporabnika, tj. na njegov odziv, interpretacijo, odločanje in delovanje. Po Ogoli (2019) se ti, v naši družbi globoko zakoreninjeni predsodki, v slovarju UI imenujejo predsodki strojnega učenja, naloga razvijalcev in uporabnikov sistemov UI pa je, da jih prepoznajo in njihov vpliv čim bolj omejijo. (Bregant, 2020)
Prvi korak za dobro in pravično družbo, ki vključuje UI, je lahko vzpostavitev kodeksov, načel, smernic, pravil in vodil, saj Grün poudarja, da ljudje za *svoje* etično ravnanje le-te potrebujemo. Pravo in zakon nista isto kot etika. Samo zakoni ne morejo jamčiti etičnega ravnanja in zakoni tudi ne pokrivajo celotnega spektra moralnih odločitev, ki jih morajo ljudje sprejemati. (Grün & Zeitz, 2011) Omejitve, vodila na področju etike in UI so že zapisana in zagotavljala naj bi etično ravnanje in vodila za dobro vseh vpletenih. To so tako dokumenti multinacionalk (Google, IBM; UNICEF, Facebook), kodeksi različnih družbenih skupin, aktivistov (Kampanja za ustavitev ubijalskih robotov), družbe ali zaprte skupine (Inštitut za prihodnje življenje). (Boddington, 2020) Prav tako so se regulacije lotile oblasti. Na ravni Evropske unije so sprejeti številni dokumenti: Krepitev zaupanja v UI, osredotočeno na človeka (COM, 2019 (168)) Etične smernice za zaupanja vredno UI (COM, 2019). Bela knjiga o umetni inteligenci – evropski pristop k odličnosti in zaupanju (Evropska komisija, 2020) in OECD načela UI. V Združenih državah Amerike je Ministrstvo za obrambo sprejelo Etična načela Umetne inteligence (DOD Adopts Ethical Principles for Artificial Intelligence, 2020) na Kitajskem pa so podporo Ministrstva za industrijo in informacijsko tehnologijo Belo knjigo o umetni inteligenci (CAICT The China Academy of Information and Communi, 2022) Tisto, kar bode v oči, je, da je vsem dokumentom skupno intenzivno izpostavljanje, izrazit trud nosilcev moči, da pri ljudeh vzpostavijo zaupanje v umetno inteligenco in v ohranjanje varnosti. Pri tem pa umanjka predstavitev, ali je vključitev dobra za družbo, za človeštvo, ali pa je dobra zgolj za nosilce moči?

Podoba vprašanja si je zastavil Hagendorff (2020), ki je analiziral etične kodekse UI in ugotovil, da se skoraj v vseh kodeksih pojavljajo načela: odgovornosti, zasebnosti, poštenosti, transparentnosti in varnosti. V nobenem ne najdemo: skrbnosti, družbene odgovornosti, dobrobiti in pomoči. Še več, kodeksi ne pridejo niti blizu razmišljanju temam o: (ne)varnosti eksistence človeštva, v nobenem se ne dotaknemo vprašanja politične zlorabe sistemov UI, pa tudi o zlonamernosti splošne UI ni besede. Kodeksi (Hagendorff, 2020), se hitro spreminjajo in nakazuje na hitro spreminjanje področja, na nedoslednosti in včasih tudi na nerazumevanje družbe ali na nerazumevanje UI. Zato se vedno znova vzpostavlja vprašanje učinkovitosti kodeksov, ki se navezujejo na etiške vidike uporabe in vpeljave UI.

Zakaj jih potem sprejemamo, zakaj bi jih morali sprejeti v izobraževalnih sistemih in zakaj bi morali biti pri sprejemanju previdni? Na splošno, sprejemamo jih, ker vsebujejo norme in pravila, vodila, smernice, včasih so celo razširjena na etično ravnanje in obnašanje članov skupnosti, ki sprejmejo etični kodeks, tako da posamezniku podajajo smernice za etično ravnanje in odločanje, saj so med zakonom in prostem odločanju. Na področju izobraževanja se kodeksi oblikujejo in uporabljajo na več nivojih:

- Imamo deklaracijo Izobraževalne internacionale o poklicni etiki, ki ga je sprejel Sindikat vzgoje, izobraževanja, znanosti in kulture Slovenije leta 2002, ki deklarativno opredeljuje osebno in kolektivno poklicno odgovornost učiteljev in drugih zaposlenih v izobraževanju.
- Imamo različne individualne kodekse etike in kodekse ravnanj, ki so jih pripravile šole in vrtci sami ali v okviru društev (npr. Kodeks etičnega ravnanja v vrtcih (Domicelj, Ferjančič, & Pavlovič, 1996), Kodeks sožitja (SMM-SCC, 2013))
- Imamo kodekse etike in kodekse ravnanj, ki so v uporabi na univerzah.

Večina pregledanih in navedenih kodeksov se ne spreminja in ne prilagaja spremembam v družbi, nekateri so stari več kot dvajset let, kar pomeni, da nimajo vključene niti odgovorne rabe in uporabe osnovne informacijske-komunikacijske tehnologije. A vendarle postaja uporaba sistemov UI naš vsakdanjik. Zakaj potem kodeksi? V primeru UI je razlog ravno v hitrem razvijanju področja, s čimer se odpira veliko polje možnih zlorab in povzročanju namerne ali nenamerne škode živim bitjem in okolju. Pri tem je potrebno izpostaviti, da so kodeksi namenjeni ljudem, ne UI kot samostojni in avtonomni entiteti.

Pravice živali, etične kodekse za ohranitev okolja ipd. smo sprejeli, da zaščitimo živali, bitja, okolje, tudi ljudi pred zlorabami ljudi. Zato tudi v tem primeru govorimo predvsem o (samo)omejevanju človeka in ne tehnologije ter o zaščiti človeka pred človekom. Zakaj moramo biti pri sprejemanju le-teh previdni?

Prvič, če so zapisana zelo podrobno, si lahko zaradi kontekstualne občutljivosti, nasprotujejo. Drugič, če so zapisana zelo ohlapno in splošno, je možnost interpretacij tako velika, da je vsako ravnanje mogoče upravičiti kot etično Tretjič, kodeks je sprejet zaradi zunanjih pritiskov, a je zgolj mrtva črka na papirju, ki je deležniki ne bi spoštovali ali pa niti poznali. Četrtič, lahko ga sprejemajo nosilci moči ali strokovnjaki, ki se ukvarjajo z določenim področjem, a niso strokovnjaki na področju etike. Na primer, če skupina tehnoloških milijarderjev iz Silikonske doline, ki so ozko specializirani strokovnjaki, sestavi kodeks, kjer je zapisano, da je potrebno delovati v dobro človeštva, ali imajo vedenje in občutek za pomen tega? (Boddington, 2020)

Če strnemo, priprava kodeksov in delovanje v skladu z njimi ni najlažja naloga. Zraven tega, sami kodeksi, vodila, smernice, niso dovolj. Deontološki pristop (kodeksi z načeli, dolžnostmi, prepovedmi) ima težavo s ponotranjanjem vodil. McNamara, Smith in Murphy Hill so raziskovali vpliv etičnih načel zapisanih v kodeksu na etično odločanje inženirjev informatike in računalništva. Izkazalo se je, da je vpliv skoraj ničen. (Hagendorff, 2020)

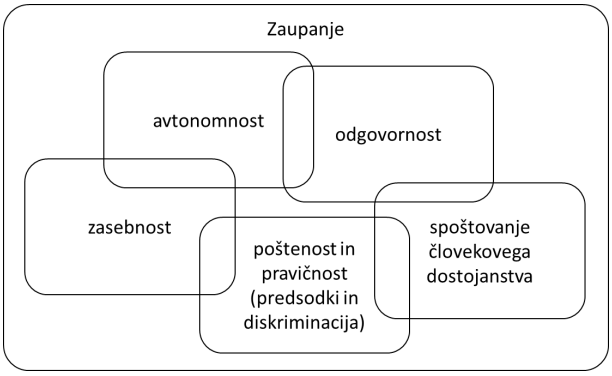
Rezultati raziskave o uporabi digitalnih medijev in spletne varnosti med osnovnošolci so pokazali, da učenci nujno potrebujejo ustrezno izobraževanje (Blažević I., 2022, str. 141). Če torej, želimo slediti razvoju UI in njene uporabe, se moramo samoomejiti podati moramo smernice z vrednotami, ki ohranjajo človeštvo in zavedati se moramo, da se bodo načela in vrednote spreminjale skupaj z razvojem UI ter posledično razvojem družbe. Če želimo, da bodo imeli kodeksi vsaj minimalni vpliv, da bomo UI pismeni ter tako izkoristili pozitivne elemente, ki nam jih UI ponuja, hkrati pa se bomo zavedali vseh nevarnosti, moramo po sprejetju etičnega kodeksa pričeti z UI opismenjevanjem.

Etika umetne inteligence in izobraževanje

UI v izobraževanju je v Sloveniji na začetku razvoja. Razumevanje, kako univerze pripravljajo študente, da bodo postali profesionalci UI ali pa da bodo vsaj razumeli delovanje UI je tako ključno za bodoče aktivne uporabnike UI.

Zato je izobraževanje o UI in kritičnem mišljenju (razumevanje in ocenitev pridobljenih informacij) zelo pomembno. Žal, zastavljanje specifičnih etiških vprašanj in razprave o etičnih vidikih, ki se nanašajo na ustvarjanje UI za izobraževanje in uporabo UI v izobraževanju, capljajo daleč za drugimi področji. (Holmes, 2021)

Glede na raziskave (Garrett, Beard, & Fiesler, 2020) so najpogostejše teme v učnih načrtih, ki so namenjeni etiki v UI (ali so zgolj del drugih učnih načrtov), zasebnost (podatki, ekonomija) ter predsodki in pristranskost (diskriminacija, poštenost, neenakost, seksizem). Predsodki in diskriminacija, nepravičnost, rasizem, seksizem, ksenofobija, zasebnost, avtonomnost in nadzor so etiški koncepti, kateri se neposredno ali posredno pojavljajo na področju razprave etike UI. V prispevku se bomo lotili konceptualne analize nekaterih, saj je razumevanje pojmov ključno za razumevanje zaščite oziroma za prepoznavanje nevarnosti izgube načel.



Slika 1: Načela etike UI v izobraževanju

Umetna inteligenca v izobraževanju in načelo zasebnosti

Zasebnost je ena temeljnih človekovih pravic, ki razmeji posameznika od kolektiva. Mill (2003) je poskušal ločiti zasebno od javnega. Država sme posegati s prepovedmi in z zapovedmi dejanjem posameznikom v javni sferi zgolj in samo tedaj ko dejanja posameznika škodijo drugim v skupnosti. Zasebnost (informacij, prostora, odločitev) tako reguliramo s pravnimi normami, zakoni in etičnimi načeli, s tem pa razmejimo posameznika od kolektiva, tako da lahko razvije lasten Jaz, da se zaščiti pred zasmehovanjem ter kontrolira svoj ugled. Zasebnost postavi družbo napram moči države oziroma nosilcev moči in tako omogoči, v primeru zlorabe oblasti, možnost upora.

Načelo zasebnosti se pojavlja v vseh kodeksih, v pravnih aktih in predpisih podjetij, društev, institucij. Je načelo s katerim se uporabnik dandanes pogosto sreča (npr. v vrtcu in šoli starši oziroma skrbniki podpišejo izjavo, soglasje, o dovoljenem fotografiranju in o objavljanju fotografij otroka na različnih javno dostopnih družbenih omrežjih). Tudi če želimo uporabljati Google (Youtube,), Meta (Facebook), Instagram, WhatsApp odkljukamo soglasje s pravili tega podjetja, kjer je vključeno tudi načelo zasebnosti.

Zaznane so naslednje težave:

a) Z UI se meje zasebnim in javnim premikajo. Že pri osebnem partnerstvu bi se zdelo, če bi ji/mu morali posredovati informacije, kje smo bili vsako minuto, kaj smo delali, kaj vse smo pregledovali na spletnih straneh, kaj vse smo označili, da nam je/ni všeč, itd., da je to nedopustno poseganje v zasebnost in nespoštovanje. Če bi nam povsod namestili kamere, sledilnik na telefonu, bi se morda uprli, saj bi se nam zdel prevelik poseg v zasebnost in nespoštovanje ter nezaupanje. V primeru, da bi v izobraževanju vse te podatke zahtevalo vodstvo ali da bi učitelji zahtevali te podatke od učencev, bi se nam skoraj zagotovo zdelo nesprejemljivo, nespoštljivo in poseganje v zasebnost. Ali bi tujca povabili v svoje zasebne prostore, da se sprehodi po stanovanju kot smo v Covid času, pri delu na domu, naredili z vklapljanjem kamer? Na vse to pristanemo, ko dovolimo zbiranje podatkov oziroma t. i. rudarjenje podatkov.

Pa vendar nismo odgovorni zgolj uporabniki, temveč tudi oblasti, zasebna podjetja, ki nam dajejo lažni občutek zasebnosti in varnosti, kar je Peter Swerle imenoval Zlata doba nadzora (Zuboff, 2019). V primeru, da učitelji uporabljajo družbena omrežja za komunikacijo z učenci, se lahko meje med zasebnim in javnim premikajo. Pogovor lahko poteka skozi ves dan, tudi zvečer, komunikacija je lahko manj formalna kot v izobraževalni instituciji, podatke, ki jih pridobi učitelj lahko vplivajo na njegov odnos, vrednotenje učencev in vice versa. Takšna zameglitev meje in hkrati možnost slednja zapisanemu in poslanemu, pa lahko pri tistih, ki se tega zavedajo, povzroči nerazkrivanje misli, idej, občutkov. Povzroči torej nezaupanje med učenci in učitelji, s čimer se izgublja dragocen odnos in možnost uspešnega dela ter osebnega razvoja obojih.

b) Vzemimo primer vpisa otroka na dejavnost. To storimo le preko aplikacije, ki zahteva številne podatke in nujno strinjanje s fotografiranjem in snemanjem otroka ter objavljanjem na družbenih omrežjih. Če tega ne storimo, aplikacija ne dovoli nadaljevanja in prijave. Vrtci, šole, društva (lahko) sprejmejo obvezno uporabo določenih aplikacij, s čimer formalno ali neformalno prisilijo učence in starše, da se odrečejo zasebnosti.

c) Dokumenti o varovanju zasebnosti, ki jih podpišemo oz. odkljukamo, pomenijo prenos odgovornost uporabe in posredovanja podatkov na uporabnika (starše, skrbnike, zaposlene). Ni mogoče vedeti, da se posameznik zaveda, kaj pomeni strinjanje. Nekatera podjetja imajo toliko pravil, da jih redkokdo prebere, razume in deluje v skladu s svojim premislekom (npr. Google (Privacy Policy, 2022), spet druga imajo (npr. TokTok (Privacy Policy, 2021)) jasno zapisano, katere informacije, ki bi jih lahko razumeli kot zasebne, se zbirajo, pa to ne odvrne množice ljudi od uporabe. Morda je razlog ravno v nepoznavanju pomena načela zasebnosti in nepoznavanju načela avtonomnosti razlog za na videz nujno uporabo umetne inteligence v zahodnem sodobnem svetu.

d) Z zbiranjem, analiziranjem in primerjanjem podatkov se gradijo dnevne rutine posameznika, predvidevanja o njegovem političnem, verskem in svetovnem nazoru. Še več, posameznike razvrščajo po določenih skupinah (npr. na zaupanja vredne državljane, na nezaupanja vredne državljane, na povprečne). Na področju zdravstva in zavarovanja razdeljevanje na podlagi prostočasnih dejavnosti, razvad in navad, na podlagi rase, četudi so imeli podobno diagnozo, spola ipd. (Borenstein & Howard, 2020) Na področju izobraževanja, bi tako lahko vodstvo ali učitelj z uporabo sistema UI in pridobljenimi podatki, učence in zaposlene razdelil na tiste, ki obetajo, na povprečne in na tiste, ki so pod povprečju. Pravzaprav to z nivojskim poukom že počnemo, kje je torej težava?

Sistemi UI so sestavljeni iz algoritmov (interna logika delovanja) in podatkov (zelo velik učni vzorec za globoko učenje). V obeh se lahko pojavijo neželeni zapleti; algoritmi so lahko napačni, podatki pa so lahko pristransko izbrani. Tako pri vsaki uporabi UI lahko nastanejo napake. Prav tako nimamo nadzora, da se podatki, ki jih uporabimo za interakcijo s sistemi UI v resnici ne shranjujejo in nas klasificirajo.

Vemo, da korporacije na podlagi pridobljenih podatkov predvidevajo tudi politično usmeritev, svetovne nazore ipd. posameznikov, kar daje moč lastnikom teh informacij, da manipulirajo z ljudmi ter jim odrekajo neodvisno razmišljanje in samostojno odločanje. Zato Su in Zhong priporočata čim večjo uporabo problemskega pouka pri skupinskem projektnem delu, s čimer izboljšamo veščine kritičnega mišljenja, veščine reševanja problemov in razvoj socialnih kompetenc. (Zhong & Su, 2022) S tem pa prehajamo na naslednja koncepta, tj. načelo avtonomnosti in spoštovanja človekovega dostojanstva.

Umetna inteligenca v izobraževanju in načelo avtonomnosti

Po Kantu (2020) avtonomnost ne pomeni, da lahko delaš kar hočeš, pomeni biti razumen in v presojo vključiti druge moralne subjekte ter izključiti pristranskost. Avtonomna oseba izbira oz. sprejema odločitve o ravnanju (ima svobodo izbire) premišljeno, na podlagi samostojnega tehtanja razlogov za in proti (je neodvisna pri razmišljanju) in v svojem ravnanju uresničuje zgolj in samo premišljene odločitve (je razumna oziroma "se odloča in deluje v skladu z načeli ali na podlagi razlogov, ki bi prepričali vsako razumno bitje.") (Klampfer, 2003). Njene želje in hotenja morajo biti avtentične, pristne, resnično naše in imamo za to dovolj dobre ter upravičene razloge, moramo imeti tudi zmožnost izpeljave in razumnost ter odsotnost pritiskov pri izbiri in delovanju. Predpogoj za navedeno pa so: dostopnost informacij, razumevanje informacij in sprejetje informacij. Zato sta že pred več kot dvajsetimi leti Aiken in Epstein (2000) zapisala, da je za zaščito skupnosti in človečnosti, za vsako ceno potrebno zaščititi človeško sposobnost reševanja problemov in razumnega razmišljanja.

Tako sledi, da v primeru UI neosveščenosti ali v primeru manipuliranja in zavajanja uporabnikov, njihove želje in hotenja niso več avtentične, pristne in resnično njihove. Torej tudi odločitve niso avtonomne in jim ne moremo pripisati moralne odgovornosti, ki izhajajo iz avtonomnega odločanja.

Umetna inteligenca v izobraževanju in spoštovanje človekovega dostojanstva

Po Kantovi (2005) drugi formulaciji kategoričnega imperativa smo ljudje dolžni drug drugemu, da: 1.) Vedno ravnamo z drugimi kot s ciljem (zaključkom, koncem) na oz. po sebi. in 2.) Nikoli ne ravnamo z drugimi zgolj kot s sredstvom.

Če nekdo ni podal prostovoljnega pristanka, ki bi bil sprejet po premisleku na podlagi njemu razumljivih informacij oziroma kot posledica avtonomnega odločanja, temveč je prostovoljni pristanek podan, ker je nekdo na nas namerno vplival, nas popredmetil, instrumentaliziral, z nami manipuliral in nas zavajal, potem je kršeno načelo spoštovanja človekovega dostojanstva ter načela avtonomije.
»Nekateri raziskovalci menijo, da smo ljudje v dobi digitalnih tehnologij, ki jih s pridom uporabljamo, postali surovina, iz katere tehnološka podjetja naredijo končni izdelek, to je napovedi o nas: kaj bomo kupili, kam bomo šli, s kom se bomo družili, kaj bomo delali, koga bomo volili itn.« (Bregant, 2020, str. 9) Postali smo torej sredstvo, kar pa ni nič neobičajnega in spornega. Učitelj je sredstvo učencem, da pridobijo vedenje, učenci so učitelju, da opravlja svoj poklic in pridobi plačilo. Težava nastane, če nas uporabijo *zgolj* kot sredstvo.
V primeru, da se zbrani podatki prodajajo in uporabljajo tudi z namenom vplivanja na naše navade, običaje in želje ali celo spreminjanja, nas s tem uporabljajo zgolj kot sredstva, odvzamejo nam avtonomnost, kar pomeni, da ne spoštujejo človekovega dostojanstva, sočloveku ne priznavajo intrinzične vrednosti, tj. vrednosti same po sebi, temveč zgolj instrumentalno vrednost. S tem ustvarjajo monopol ne zgolj nad sedanjostjo človeštva, ampak tudi nad prihodnostjo, saj lahko s ciljnimi izdelki poljubno vplivajo na njihovo obnašanje in ga usmerjajo skladno in zgolj z lastnimi interesi.

Umetna inteligenca v izobraževanju in načelo zaupanja

Lepilo družbe, lepilo partnerske zveze je zaupanje in spoštovanje. Oboje pa je povezano z resnicoljubnostjo. Učenci in starši zaupajo informacijam, ki jim jih posredujejo učitelji, zaupajo trenerjem, da jim ne bodo škodovali ter da bodo delali v njihovo dobro. Učitelji zaupajo, da je oddano nalogo pripravil učenec sam, zaupa, da je korektno navajal vire, zaupa, da mu učenci ali starši ne bodo namerno škodovali. Vodstvo šole zaupa učitelju, da je pošten in nediskriminatoren ter skrben. V situaciji, ko temu ni tako, je zaupanje ogroženo. Brez omenjenih temeljev, zaupanja in spoštovanja, pa družba razpada. Zato je zaupanje v UI osrednja težnja nosilcev moči, o čemer smo govorili v prvem delu tega prispevka. Tudi zato, ker je bilo napak, diskriminacij, nepoštenosti, ki izhajajo iz uporabe umetne inteligence, veliko. Možnosti zlorab pa je še toliko več. Na primer, sistem UI je pri obdelavi naravnega jezika že tako napredoval, da ga ne razlikujemo od osebnega asistenta.

Če ne moremo ločiti, kdo nas kliče, sistem UI ali dejanska oseba, se polje možnih zlorab samo še odpira. Če sistem UI lahko sam napiše recenzijo knjige, kako naj učitelj loči med učenčevim izdelkom in izdelkom sistema UI?

Zadnje obravnavano načelo je ključno za vsa ostala načela ter za vse deležnike. Zaupanje pri uporabi sistemov UI pa je zelo kompleksno. Zaupamo, da je sistem UI (produkt človeka) razvit na način, da so odzivi in interpretacije pravični in nediskriminatorni. Zaupamo, da se zbirajo in obdelujejo zgolj podatki, ki smo jih dovolili. Zaupamo, da ne bo oblikovan, da bi škodoval posamezniku. Zaupamo, da bo spoštoval avtonomnost individuumov. Zaupamo, da so naročniki, razvijalci in uporabniki pravični, nediskriminatorni, da sledijo načelu neškodovanja in dobronamernosti ter da spoštujejo človekovo dostojanstvo in avtonomnost. Če je temu tako, lahko imamo zaupanje v UI. Pa vendar: *"Kako je sploh možno misliti, da bo nekdo kupil sredstvo (medij), s katerim je mogoče vplivati, in se hkrati odrekel temu, da bi vplival na njegovo usmeritev?*" (Halimi, 2003)

Analiza konceptov zasebnosti, avtonomije, človekovega dostojanstva in zaupanja je pokazala, da je dobro razumevanje, ponotranjanje in posledično delovanje v skladu z njimi nujno za uspešno ustvarjanje in uporabljanje sistemov UI.

Zaključek

Prenehati si moramo predstavljati UI kot objektivno in vrednostno-nevtralno. Sistemi UI temeljijo na algoritmih, ki odražajo vrednote ustvarjalcev in tistih, ki delujejo s pozicije moči. Predvsem pa je pomembno, da prevzamejo odgovornost vsi deležniki, od programerjev do uporabnikov. Samo tako bo nastala simbioza vseh in ne vzpostavitev dveh nasprotujočih si polov; peščice bogatih nosilcev moči in velike večine UI neosveščenih in neveščih revežev. Začeti se mora v vseh nivojih izobraževalnega sistema: z zapisi v kurikul, z izvajanjem zapisanega, s treningi razvijanja občutka (občutljivosti) na etične izzive, prepoznavanjem dilem, razvijanjem odločanja in razvijanjem vrlin in vrednot vseh deležnikov v izobraževanju, ki bodo omogočile kvalitetno prihodnost človeštva. Zraven etiških veščin in etičnega zavedanja, pa je potrebno krepiti njihovo kritično razmišljanje, krepiti kognitivne in socialne veščine, saj bomo zgolj in samo tako ubranili zlorabo sistemov UI pred nosilci moči.

Summary

An individual who has access to information, an understanding of and ability to evaluate information, and the capacity to act in accordance with the evaluation is most often at an advantage over other members of society. The post-COVID period has brought a rise in and growth of artificial intelligence in all areas of our lives, including in the field of education. Therefore, if we speculate, individuals with access to information about artificial intelligence (AI), with knowledge of how artificial intelligence works, with the ability to create artificial intelligence, and with the understanding of and ability to evaluate this information and act according to the evaluation, will be at an advantage, or will take an active role in those companies creating AI.

Codes of ethics (advantages and disadvantages) are presented in the context of a formal framework for AI in education and the current failure to include these in educational curricula. We also point out that creating codes of ethics is not the final goal; it is the process of implementing them into the educational process that needs to be achieved. By understanding ethical concepts, by internalizing them, there is a possibility that people will also act ethically, so we need to educate people, familiarize them with the advantages and disadvantages of AI. One effective way is to offer workshops and training with problem-based project teaching, where students can strengthen their problem-solving skills, critical thinking skills and ethical skills.

The article analyses the four principles underlying the ethics of AI in education: privacy, autonomy, respect for human dignity, and trust. First, we discuss contemporary data gathering from the perspective of privacy invasion; mandatory software submission of data that people may not want to reveal but which is obligatory for the enrolment process. Software designers should work with ethical committees when preparing web services. Second, we discuss the influence of AI on autonomous decisions that can be impaired without a thorough information overview. Learners today (especially children) do not question the credibility of the information provided by AI. We need to put effort into education leading to an understanding of the workings of AI and the decision processes. Third, because of a lack of autonomous choices, people could be manipulated by various interest groups (political parties, multinational companies, and other bearers of power).

People can be used only as a means to achieve certain specific goals, and this violates the principles of respect for human dignity. Fourth, trust is the glue of every society; unethical actions during the introduction of AI into education could lead to general distrust of all AI, even the benevolent and useful varieties. AI in education must therefore be transparent and non-biased.

The transformation of society is a complex process that begins with young people who are not indoctrinated and are capable of accepting new ideas and internalizing them. We will not be able to remove artificial intelligence from our lives, but we can open it to explanation and scrutiny even in elementary school and thus make children aware of its advantages and potential disadvantages.

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Primeri:
Knjige: priimek, začetnica imena avtorja, leto izida, naslov, kraj, založba.
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Articles from Magazines: last name and name of the author, year published, title of the article, name of the magazine, year, issue number, page(s).

Planinšec, J. (2002). Športna vzgoja in medpredmetne povezave v osnovni šoli. *Šport*, *50* (1), 11–15.

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Fošnarič, S. (2002). Obremenitve šolskega delovnega okolja in otrokova uspešnost. V M. Juričič (ur.), *Šolska higiena: zbornik prispevkov* (str. 27–34). Ljubljana: Sekcija za šolsko in visokošolsko medicino SZD.

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