Van Hiele Level of Croatian student’s math achievements
2018-2020 Education Research Project
*Apr 2020*
HUNI - Croatian association of teacher researchers

• HUNI Goals - improvement and promotion:
  www.huni.hr

• Math sciences and math teaching at all levels, research into achievements in teaching, applying mathematics in other disciplines, and advancement of math teaching as a whole.

• Natural sciences and natural teaching at all levels, research on achievements in teaching, application of natural sciences in other disciplines, and advancement of natural science teaching as a whole.

• Social and humanistic sciences and teaching of social and humanistic subjects at all levels, research into achievements in teaching, application of social and humanistic sciences in other disciplines, and the promotion of the teaching of a social and humanistic subjects groups as a whole.
About Van Hiele Project

• Approved by **Croatian Ministry of science and education**

• Students math knowledge evaluation: **RESEARCH & TEST**
  
  - “What math content to teach and how to evaluate it”

• New and unique activity on globe level – 1\textsuperscript{st} time (no worldwide benchmark)

• **Van Hiele theory** to become **Croatian Standard** for math: knowledge & evaluation and curriculum implementation

• **University of Zadar** is educational project partner

**2019 REACH in Croatia:**

• 9 cities - 15 schools: 5 primary & 10 secondary

• Year 2019 testing = 59 classes

• 8 in primary and 51 in secondary schools

• 1,336 Croatian students

• >50 Croatian math school teachers

• 5 Croatian university math professors

• 2 foreign math experts

• 2018 y. project preparation + 2 school y. testing duration (2019-2020)
Project description

- The project is focused on the teacher's determination and increase in student achievement levels in the basic concept of mathematics - in the concept of functions and concrete functions taught in school mathematics (linear, square, exponential, logarithmic, trigonometric).

- These functions are the basis of the use of mathematics in natural sciences (physics, biology and chemistry).

- The function concept is closely related to computer science, computer thinking and programming and as such a very important segment of information technology.

- An analysis of achievements beyond Hiele's levels on functions in the last 10 math matriculation exams will be done.

- With this project, we aim to find/spot/perceive beyond the Hiele level of student achievement in functions as a basic concept in our school mathematics through action research of teachers, and to offer possible improvements in teaching and learning.

- Through action research, teachers / teachers problematize the conditions of their educational activities, trying to design, apply and explore suitable solutions.
Objective of action research

With this action research, we made an initial step of teacher's reflection on teaching and the facts visible in the diagram.
All University cities included: Zagreb, Osijek, Rijeka, Pula, Split, Zadar
University of Zadar (@Symposium) issue teachers educational certifications

Project deliverables will be presented to all teachers, students and parents, Ministry of science and education and other interested.

Van Hiele tests & evaluations to be implemented in Croatian math education.
Scientific conference in Zadar

Van Hiele Theory in Mathematical Education
Van Hieleova teorija u matematičkom obrazovanju
Znanstveno-stručni skup s međunarodnim sudjelovanjem

Organizator
Sveučilište u Zadru, Odjel za izobrazbu učitelja i odgojitelja
Suorganizator
HUNI, Hrvatska udruga nastavnika istraživača

Odjel za izobrazbu učitelja i odgojitelja
Novi kampus, Ulica dr. F. Tuđmana 24 i, Zadar

(ime i prezime)
Scientific conference in Zadar

- Scientific Conference with International Participation: Van Hiele Theory in Mathematical Education: 25 - 26 April 2019
- [https://www.huni.hr/znanstveno-strucna-konferencija-u-zadru/](https://www.huni.hr/znanstveno-strucna-konferencija-u-zadru/)
- Organizer: University of Zadar, Department for Teacher Education
- Co-organizer: HUNI, Croatian Association of Researcher Teachers

At the international scientific-professional conference, expert lectures with workshops were held on aspects of action research, aspects of levels outside Hiele's model and proposal of tasks for solving in Croatian schools.

Participants from South Africa, Slovenia and Croatia, together with the students of the University of Zadar, contributed to each other's development as well as to the project as a whole.
prof. dr. sc. Michael de Villiers (SA):

“Thank HUNI so much for inviting me to participate in the Van Hiele Function Project Conference in Zadar from 25-26 April 2019. I enjoyed the visit very much and consider it a great honour to have been invited and for the wonderful opportunity to learn and see more about your country.

Even though the presentations during the Conference were in Croatian, I could sufficiently follow and was impressed with the adaptation of the Van Hiele theory of learning to the learning and teaching Functions.”

prof. Lucijana Kračun Berc (SLO):

“Konferencija je bila dobro organizirana i zahvaljujem na mogućnosti sudjelovanja, koje je i mene obogatilo, dalo razmišljati o tome kako se približiti učenicima i kako analizirati svoj rad, a zadatke za rješavanje ću omogućiti mojim učenicima. Kada ćete postojati finalni kriteriji i tablica za unos rezultata u Sloveniji ćemo to ispuniti, pa ćemo napraviti usporedbu. Hvala na entuzijazmu za promjenama na bolje.”

prof. Ljiljana Jeličić (HR):

“Bilo mi je zaista neizmjerno drago sudjelovati i boraviti s ekipom ovih dana u Zadru. Nekako mi ova druženja iznova daju poticaje da nastavim dalje, dobijem inspiraciju i nove ideje.”
Scientific conference in Zadar - feedback

_prof. Nives Baranović (HR):

“Konferencija je izvrsno osmišljena i realizirana, a bila je i uspješna jer je se radilo intenzivno, sadržajno, ciljano i motivirano uz podršku iskusnog profesora de Viliersa te vjerujem da možemo stvoriti nešto korisno. Samo treba ustrajati. Druženjem sa sudionicima konferencije napunila sam baterije i obogatila znanja da ne žalim ni jedne provedene minute.”

_prof. Branka Antunović – Piton (HR):

“Bilo je intenzivno, ispunjeno i izvrsno. Vratila sam se slatko umorna i zadovoljna.

Ekipa sva, od Petra Mladinića, Michaela de Villiersa, Nives Baranović, Maje Cindrić, kolegica iz osnovnih i srednjih škola... svi smo bili uskladena ekipa.

Osjetio se zanos, pozitiva i potreba za promjenama kako bi bilo bolje i nama i učenicima.

Nastavljamo dalje istim ritmom!”

_prof. Matea Gusić (HR):

“Skup u Zadru je bio jako lijepo organiziran i sva predavanja su bila vrlo zanimljiva. Mislim da su svi sudionici uživali, profesionalno, ali i u gostoprimstvu”

_prof. Hannah Barnes (SA):

“I am pleased that conference went well.”
2019 Test examples

Linear function

1. Povežite izraze iz lijevog stropa s odgovarajućim opisom iz desne strane:
   - $3x+2$
   - $x+3$
   - $2x+2$
   - $x$

   Odrediti broj svečan je za tri
   - $3x+2$
   - $x+3$
   - $2x+2$
   - $x$

   Odrediti broj svečan je tri puta
   - $3x+2$
   - $x+3$
   - $2x+2$
   - $x$

   Dvostupnik vrijednost određenog broja svečan je za tri
   - $3x+2$
   - $x+3$
   - $2x+2$
   - $x$

2. Povežite pravcu i lijevom stranom. Od zadane brže oduzmite 2, popunite tablicu i prikažite pravcu na bržom novcem.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

3. Dana je množica brojeva za sljedeće jednadžbe: $5x + 1 = 11$. Prikažite sljedeće stope: A. $x+1=3$; B. $x=3$; C. $x=10$; D. $x=9$.

Exponential function

1. Usporedite tablice A i B:

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1,7</td>
</tr>
<tr>
<td>1</td>
<td>2,3</td>
</tr>
<tr>
<td>2</td>
<td>2,9</td>
</tr>
<tr>
<td>3</td>
<td>3,5</td>
</tr>
<tr>
<td>4</td>
<td>4,1</td>
</tr>
</tbody>
</table>

   Za svaku od funkcija $f$, u odredjenom osnovnom tablicu je u linacima, kvadratni ili eksponencijalne. Odgojna obrazlijeđenja.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$g(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1,7</td>
</tr>
<tr>
<td>1</td>
<td>3,4</td>
</tr>
<tr>
<td>2</td>
<td>6,8</td>
</tr>
<tr>
<td>3</td>
<td>13,6</td>
</tr>
<tr>
<td>4</td>
<td>27,2</td>
</tr>
</tbody>
</table>

   Odgojna obrazlijeđenja: $x$ se temelji na odgovor.

   2. Na slici je graf eksponencijalne funkcije $f$.

   Omačite jez i trenje točke i natočite svoj odgovor.

Quadratic function

1. Koji od ponuđenih funkcija pripada dana tablica prirodnim vrijednostima:

   A. $z(x) = x^2 + 3$
   B. $z(x) = x^2 - 3$
   C. $z(x) = x^4 + 4$
   D. $z(x) = -x^2 + 4$

   Odgojno obrazlijeđenje: $x$ se temelji na odgovor.

2. Zadani su konci prema kojima funkcija u stropu ulazna vrijednost prevan u izrazno:

   a) Krenite sa zadatim ulaznom vrijednost;
   b) Oduzmite 3;
   c) Kupajte rezultat dobiven pod b);
   d) Dodajte 2 rezultatu dobivenom pod c);
   e) Dobiven je izrazni rezultat. Zapisi ga.

   Prateći zadane konke odreditte što je izlaz funkcij stropu, ako je ulaz:

   a) $-2$;
   b) $p$;
2019 Croatian Tests results

2019 Tests results in 05. & 06.2019. in Croatian schools: Notes and comments.

Media coverage

Nacional 23/04/2019 'Croatian students have huge gaps in mathematics knowledge'
The level of student achievement will be determined

Worrying: Only 3% of elementary students knew how to solve a task appropriate to their age

www.vecernji.hr/vijesti/bivsi-ravnatelj-analizira-samo-3-osnovaca-znalo-rijesiti-zadatak-primjeren-svojoj-dobi-1337643
Web Media coverage

www.huni.hr has world wide visitors from all continents
2020 Unesco Hamdan Prize Nomination

Project Van Hiele Hrvatska 2019-2020

is Croatian state official nomination for UNESCO-Hamdan Bin Rashid Al-Maktoum Prize – Sixth edition 2019-2020, for Outstanding Practice and Performance in Enhancing the Effectiveness of Teachers.

The application was submitted in collaboration of HUNI with Croatian Commission for UNESCO - Ministry of culture, Ministry of science and education, Education and teacher training agency of the Republic of Croatia.
2019 Project Sponsors

- Hrvatska Poštanska Banka d.d.
- Hrvatski Telekom d.d.
- Jamnica d.d.
- C.I.O.S. Grupa
- Croatia Airlines
- Čazmatrans
- Grad Zagreb
Petar Mladinić was born in 1950 in Zagreb, where he graduated at the Faculty of science the Department of mathematics University of Zagreb.

His work has a long lasting effect on improvement of the educational and training practices.

As a leader of the Teaching Section of the Croatian Mathematical Society, professor-mentor, Director of V. Gymnasium in Zagreb, he contributed to the development of the professional needs of teachers, students and students in formal and informal everyday and lifelong learning and teaching. He has organized more than 150 lectures, numerous workshops, initiated Ruđer Bošković summer school and the Summer School of V. Gymnasium and Croatian Mathematical society.

For the professional needs of teachers, students and students, he founded four mathematicians Magazines: Poučak, Matka, Playmath and math.e and initiated the publication of books under a Little Mathematical and Matka Libraries.

He wrote about a hundred professional articles, books, grammar textbooks and other textbooks, inspired translations and translated several books, and organized dozens of workshops for teachers and students.

He contributed to the development of the education system in mathematics as a member of the National curriculum council and a member of the Working group for the development of the National Framework curriculum for mathematics. In 2011 he submitted and conducted a project IPAQ Peta (http://ipaq.petagimnazija.hr/en/) - Affirmative Teaching innovative teaching in gymnasiums within the National Educational Program, realized with the teams of four gymnasiums - from Vukovar, Pakrac, Knin and Metković and the Faculty of science the Department of Mathematics at University of Zagreb, with the participation of 1,200 students and 1 000 teachers.

He has conceived and organized a two-year meeting of teachers and math teachers (meetings and congresses of mathematics teachers) where Croatian teachers have been present, as well as the most prominent foreign experts in the field of math teaching. He founded the Croatian branch of TTT (Teacher Teaching Technology). He founded and led the Croatian Mathematical society geometry workshops for many years.

As a teacher, and especially as a director of V. Gymnasium, he is actively involved in the community, strengthens democratic processes, tolerance and solidarity among young people and their parents.

He was awarded by the Homeland war memorial 1990th to 1992th, medal of the Order of Croatian Trefoil and the 2015th Croatia state award Ivan Filipović for achievements in the secondary education segment.
Thank You

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