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**WEB-site for physics ( electricity and  
electronics) learning**

Master's Thesis

(30 ECTS)

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## Annotation

The purpose of this work is to create a website to help teachers of a school or a gymnasium in the preparation of small trainings in physics. Also, in principle, the site can be used for other school subjects and communication between students and students among themselves in the process of studying. Now site address is <http://www.peegel.ee/game>

When writing the site, the programming languages of the PHP, JavaScript (jQuery) were used, CSS Framework Twitter Bootstrap and the MySQL database.

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## Introduction, background

Training through the Internet has existed for at least 10 years and only has a tendency to increase its volume, here I would like to refer to an article „5 Top Trends in Education Technology 2015” by Aaron Skonnard <sup>[1]</sup> :

“ ... the education sector is continuing to increase its investment in technology related to learning. Ed tech funding jumped 55 percent in 2014 with no signs of slowing down, according to CB Insights. A report from Global Industry Analysts (GIA) predicts that the global e-learning market will reach \$107 billion in 2015 ...”

As I understand it, the general trend in Internet education is that serious courses are being created, both text and video, students cheat them and pass some tests. I'm not going to compete with such giants as <http://www.khanacademy.org/>, <http://www.codeschool.com> or <https://www.coursera.org>.

There is one more adjacent niche in training - computer games training. Children, schoolchildren have always loved and will love to game, so I would like to work in my work to combine games with the training course. And the material of the course can be prepared by the teacher himself.

There is another inconvenient moment in the above sites - they are all only in English. In my work, in principle, I set out to create a multilingual website with the principal possibility in the future to add more languages. At the moment, support is provided for 3 languages: Estonian, Russian, English. It is also possible to copy the texts of the courses from one language to another, since some questions contain numbers and formulas that are equally written in all these languages.

Objectives of this master' Thesis:

1. Identify the software used to create the site
2. Describe in detail the scenarios of the site
3. Describe the possibilities of working with the site for different kinds of users
4. Describe the project database for the site
5. ERD of Data Base
6. Describe the general principles of the program code
7. Process of work with the website for the simple user
8. Process of work with the website for the teacher
9. Process of work with the website for the scholar

## 1. Identify the software used to create the site

The following software was used to create the site:

- PHP – version 5.2.12
- MySQL -Client API version 5.0.51a with PDO support
- JavaScript
- JQuery Framework, version 2.2.3
- CSS Framework Twitter Bootstrap
- Graphics editor Photoshop for raster graphics

It is a practically standard set of LAMP - Linux, Apache, MySQL and PHP . It has been made because of its full free of charge for the end user. The final version of the website was placed on the virtual server of provider ZON E.EE

When programming the website I was it is used generally programming model MVC .

Has been created and was used own small Framework from 15 classes of PHP.

CSS Framework Twitter Bootstrap has been used in order that the website could be the worker both for big screens and for mobile devices - phones or tablets.

## 2. Describe in detail the scenarios of the site

### *Game target:*

Gamer goes from one end of a game field to another and must save of our life. In the course of passing of the game field the player has to answer questions which to him will be asked by opponents dragons. In case of the correct answer the result in the form of points registers in the database. Wrong answers are also fixed in the database for the next analysis.

### *Enemies/opponents:*

Gamer can to use against enemies weapon or knowledge (this is she/he choise) – but, if gamer use weapon, then lose power, life or puncts, if gamer use knowledge he/she loses nothing.

Opponents divide by 2 type: simple and hard (dragons).

*Simple enemies* can ask simple questions – simple formulas or excercises.

*Ddragons* can to ask difficult questions: for many variants of answers or little esse - in this case in game must to join in game teacher, this it means that the assessment of the answer will be postponed for later time or this option can to use in control work in class?

### *Game protsess:*

When game started game he/she have life, movement across the field decrease life on every cells:

- Sand/groud – minus 1 puncts
- Grass - minus 2 puncts
- Forrest – minus 3 puncts
- Water – minus 4 puncts
- Mountains – mountains can be not passable at all or to demand specialtransport

Some types of obstacles, for example gate, can demand additional calculations, for example the current or tension for opening of the electric lock.

### *Tools/weapons:*

In start game gamer can to choise tools or weapon, if hero type have big life then can to use not big power weapon and on the contrary – if hero has power weapon he life in start is not big.

Tools or weapons also can be to meet in the field it is casual, but it isn't frequent.

Some types of tools or the weapon can have batteries, which demand recharge. Can load them electric dragons who ask thus questions about the subject Electricity.

### Life:

As was written earlier in game start gamer receives life, when he/she goes to field, it loses life, also loses life when contacts with enemies.

### Life restoration types:

- Objects on game field, which happen (onions, berries, mushrooms, flags)
- Points from dragons with right answers

### Characters:

One user can use up to 5 characters, they can be of different types, names, tools and others. If a character is dead (life=0%) it becomes inaccessible to the user, but info can be saved in database.

Of course yet not all this scenario is realized in full. Development process of any software never stops.

The general template of the website looks as follows:

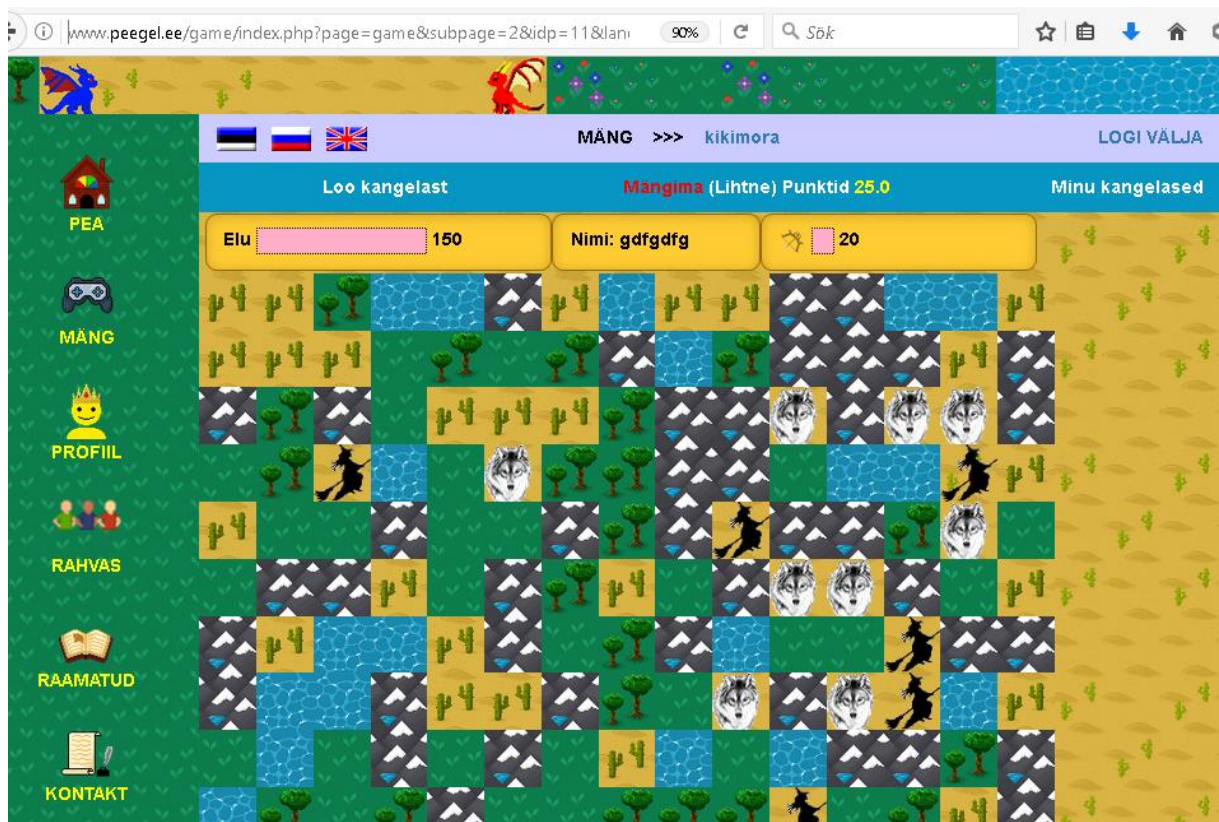


Figure 2.1. Site general view

### 3. Describe the possibilities of working with the site for different kinds of users

On the website there can be 4 types of users:

- Simple user
- Scholar
- Teacher
- Site administrator

#### *Simple user*

Can play/use any not private courses.

#### *Scholar*

Sees only courses of the teacher, but can at desire pass into regime of the simple player

#### *Teacher*

Can create courses, create and attach to them the Scholars, can pass into regime of the pupil or simple user and back into the mode of Teacher

. This option is necessary in order that the teacher could look at a course from the point of view of Simple user or Scholar

### 4. Describe the project database for the site

Database – 19 Tables:

#### *Users and equipment*

<b>Name</b>	<b>Description</b>	<b>Several details (fields)</b>
<b>Users</b>	Gamers, teachers, admins and moderators (if need)	<b>Id</b> – id of User <b>Name</b> <b>Lastname</b> <b>Nick</b> <b>Email</b> <b>Pass</b> <b>Date_reg</b> – User's registraion date <b>Tel</b> – phone of User <b>Role</b> field: 0- simple user 1 - scholar



		<p>2 - Teacher (may to create the courses)</p> <p><b>Reg_complete</b></p> <p><b>Reg_code</b></p> <p><b>admin</b></p> <p>10- moderator</p> <p>100- admin</p>
<b>Heroes</b>	Heroes types with descriptions	<p><b>Idh</b></p> <p><b>Ee</b></p> <p><b>En</b></p> <p><b>Ru</b></p> <p><b>Dee</b></p> <p><b>Den</b></p> <p><b>Dru</b></p> <p><b>life</b></p>
<b>Enemies</b>	Enemies types with descriptions	<p><b>Idc</b></p> <p><b>Ee</b></p> <p><b>En</b></p> <p><b>Ru</b></p> <p><b>Dee</b></p> <p><b>Den</b></p> <p><b>Dru</b></p> <p><b>power</b></p>
<b>Arm</b>	weapons, tools and medicine objects, description and maximum power	<p><b>Ida</b></p> <p><b>Idh</b> - type of heroes, witch can to have this arm</p> <p><b>Ee</b></p> <p><b>En</b></p> <p><b>Ru</b></p> <p><b>Dee</b></p> <p><b>Den</b></p> <p><b>Dru</b></p> <p><b>Power</b> – maximum for this arm.</p>
<b>Persons</b>	Players can create them	<p><b>Idp</b> – id of person</p> <p><b>Id</b> – id of gamer</p> <p><b>Name</b></p> <p><b>Idh</b> – type of hero</p> <p><b>Sex</b></p> <p><b>Avatar</b></p> <p><b>Health</b> – if =0, person is dead ☹</p> <p><b>Start_date</b></p> <p><b>End_date</b></p> <p><b>Field</b> –the array which describes a condition of the game field</p> <p><b>Ida</b> - the remained power of arm</p> <p><b>Row</b> – position on game field</p> <p><b>Col</b> - position on game field</p> <p><b>Power</b> –</p> <p><b>Idc</b> – id of course</p>

Courses, questions, answers ...

Name	Description	Several details (fields)
<b>Areas</b>	Areas of knowledge – mathematica, physics, electronics ... May consist info in tree form	<b>IDAR</b> – id of course <b>Ee</b> <b>En</b> <b>Ru</b> <b>Dee</b> <b>Den</b> <b>Dru</b> <b>Parent</b> <b>ban</b>
<b>Courses</b>	Courses names	<b>IDC</b> – id of course <b>Numbers</b> – count of questions in course <b>Ee</b> <b>En</b> <b>Ru</b> <b>Dee</b> <b>Den</b> <b>Dru</b> <b>Start</b> <b>Idar</b> – area id <b>Private</b> <b>ban</b> <b>Parent</b>
<b>Questions_types</b>	Questions types descriptions on several languages	<b>Idqt</b> <b>Ee</b> <b>En</b> <b>ru</b>
<b>Questions</b>		<b>IDQ</b> – autoincr. key <b>Idc</b> – id of course <b>Ee</b> <b>En</b> <b>Ru</b> <b>Type</b> – <b>0</b> - simple number's answer <b>1</b> -yes/no <b>2</b> - 1 variant of answer from many varinants of answers (radio buttons) <b>3</b> some versions of answers (checkboxes) <b>4</b> – simple text answer <b>5</b> - yes/no + simple text answer

		<p><b>6</b> - 1 variant of answer from many variant of answers (radio buttons) + simple text answer</p> <p><b>7</b> - some versions of answers (checkboxes) + simple text answer</p> <p><b>Img</b> – 0/1 – yes or no image, associated with question</p> <p><b>Ban</b> – 0/1</p>
<b>Answers</b>	Answers for questions	<p><b>Idq</b> – id of question</p> <p><b>Idv</b> – variant of answer:</p> <ul style="list-style-type: none"> <li>• 0- text or number variant 1 / 2 – yes/no</li> <li>• 0-15- choice from variants</li> </ul> <p><b>Idq+Idv</b> – complex key</p> <p><b>Points</b> – for this variant of answer (in text answer case – max points)</p> <p><b>EE</b> – answer on estonian language</p> <p><b>EN</b> – answer on english language</p> <p><b>RU</b> – answer on russian language</p> <p><b>Ban</b> - (0/1)</p>
<b>Game_ans</b>	Gamer's answers	<p><b>Idga</b> – autoincrement key</p> <p><b>Idp</b> – person</p> <p><b>Idq</b> – question id</p> <p><b>Variants</b> – answers variant in binary format</p> <p><b>Date_reg</b> - moment</p> <p><b>Points</b> – summ of points</p>
<b>Gam_ans_text</b>	Answers of gamers if question need also text answer	<p><b>Idgat</b> – autoincrement key</p> <p><b>Idga</b> – id from <b>gam_ans</b> table</p> <p><b>txt_ans</b> – text of answer</p>
<b>Course_auth</b>	Authorship of courses. One course may have one and more authors	<p><b>Idc</b> - course id</p> <p><b>Id</b> – teacher's id</p> <p><b>Idc+Id</b> – complex key</p>
<b>Teach_school</b>	communication between the teacher, the scholar and the course	<p><b>Idt</b> – id of teacher</p> <p><b>Ids</b> – id of scholar</p> <p><b>Idc</b> – id of course</p> <p><b>Date_reg</b> – registraton date</p> <p><b>Ban</b> – (0/1)</p>
<b>Dragons</b>	Dragons with whom questions are associated	<p><b>Idp</b> – id of person</p> <p><b>Idq</b> – id of question</p> <p><b>Row</b>- dragon position on game field</p> <p><b>Col</b> - dragon position on game field</p>

*Tables for site service ...*

<b>Name</b>	<b>Description</b>	<b>Several details (fields)</b>
<b>Langs</b>	Codes of languages	<b><u>IDL</u></b> – id of language <b>Lang</b> - code of language
<b>Menu</b>	Menu of site for several languages	<b><u>IDM</u></b> – id of course <b>Ee</b> <b>En</b> <b>Ru</b> <b>Parent</b> <b>Ord</b> <b>Pages</b> <b>Add info</b>
<b>Words</b>	The dictionary of inscriptions in different languages	<b><u>kw</u></b> <b>Ee</b> <b>En</b> <b>ru</b>
<b>Texts</b>	The dictionary of large volumes of the text in different languages	<b><u>kw</u></b> <b>Ee</b> <b>En</b> <b>ru</b>

## 5. ERD of Data Base

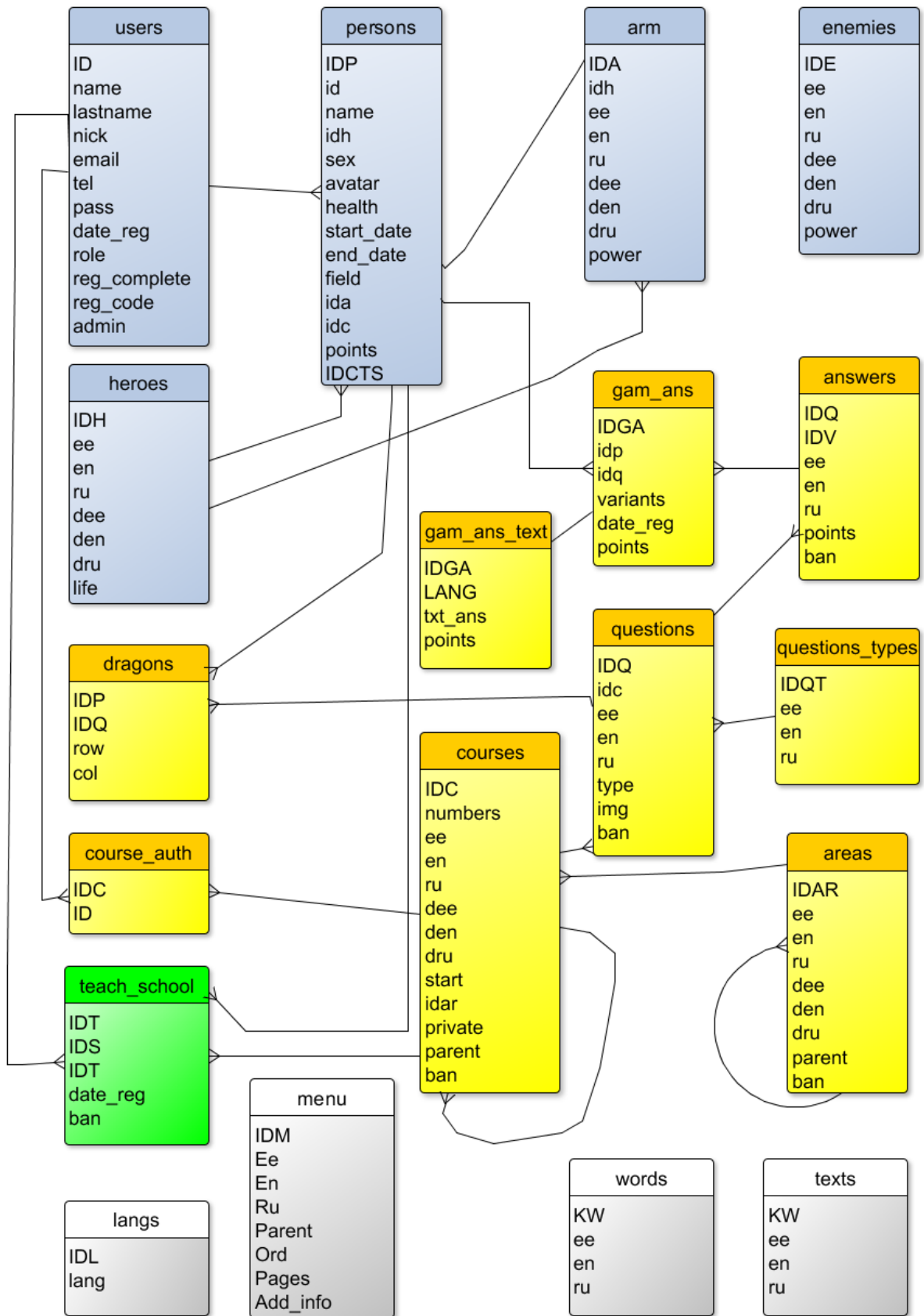


Figure 5.1. ERD of Data Base

## 6. Describe the general principles of the program code

The general principle when developing a code was in use of MVC model: Model-View-Controller. Proceeding from it the code of the website has been distributed to the 3 main folders:

- View
- Model
- Controller

All graphic content is in the view/img folder. JavaScript is in the “js” folder and PHP classes in “classes” folder. Overall picture of folders of the website such:

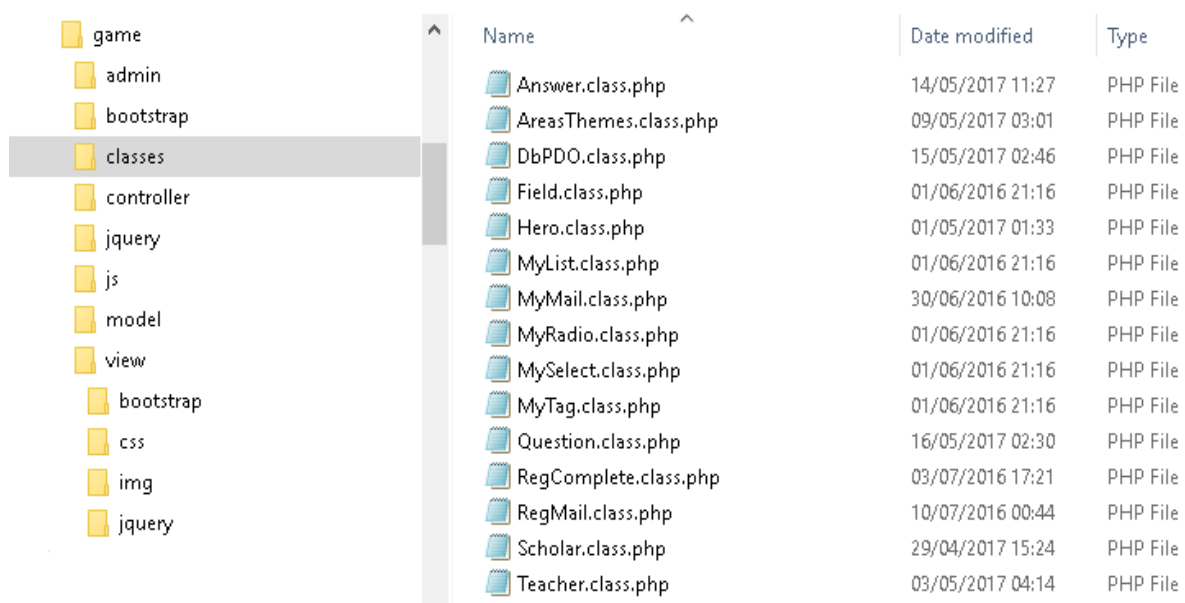


Figure 6.1. Folders and files of the website

In the main folder of the website there are only 3 files:

- Index.php
- Config.php
- Logout.php

In the index.php file there is only a connection of a cofigrator.php file and basic elements of a template from the view folder, see Figure 6.2

```
1 <?php
2 include ('config.php');
3
4
5 include ("view/head.php");
6 include ("view/menu.php");
7 include ("view/topmenu.php");
8 include ("view/body.php");
9 include ("view/footer.php");
10
```

Figure 6.2. Content of index.php file

And already in the body.php file templates of all pages of the website are connected.

```
1 <div class="row" style="padding-left:0px;margin-left:0px;" >
2 <div id="field" >
3
4 <?php include ("view/$page.php"); ?>
5
6 </div>
7 </div>
```

Figure 6.3. Content of body.php file

To connect files of controllers and a data model at the config.php file there is a code:

- include(model/\$page."Model.php);
- include(MY\_ROOT.'controller/'.\$page.'Controller.php');

JavaScript by every page is connected in the file footer.php by a code:

```
<script src="bootstrap/js/jquery-2.2.3.min.js"></script>
<script src="bootstrap/js/bootstrap.min.js"></script>
<script src="js/<?php echo "$page$subpage.js" ?>"></script>
```

## 7. Process of work with the website for the simple user

A simple user can register himself in the appropriate form, after which a link will be sent to him on the mail.

Then the user can confirm his registration by clicking on the link in his mailbox.

The image shows a registration form on a website. The form is titled "Kasutaja" and contains the following fields and buttons:

- Kasutaja**: Username input field
- E-post**: Email input field
- Pass**: Password input field
- Pass veel kord**: Repeat password input field
- OK**: Submit button

Below the form, there is a text box with the following text: "Kasutaja nimi ja pass peab sisaldama ainult (a-z, A-Z ja \_) tähte, neid pikkused peab olla".

Figure 7.1. Registraion form view

After completion of registration the simple user can create the game characters at once and choose courses for playing the game. The course can be chosen:

- absolutely casual
- casual of concrete area of knowledge
- a concrete course from concrete area

Also simple user can see results of passing of the game/test on a subpage of *My Heroes*.

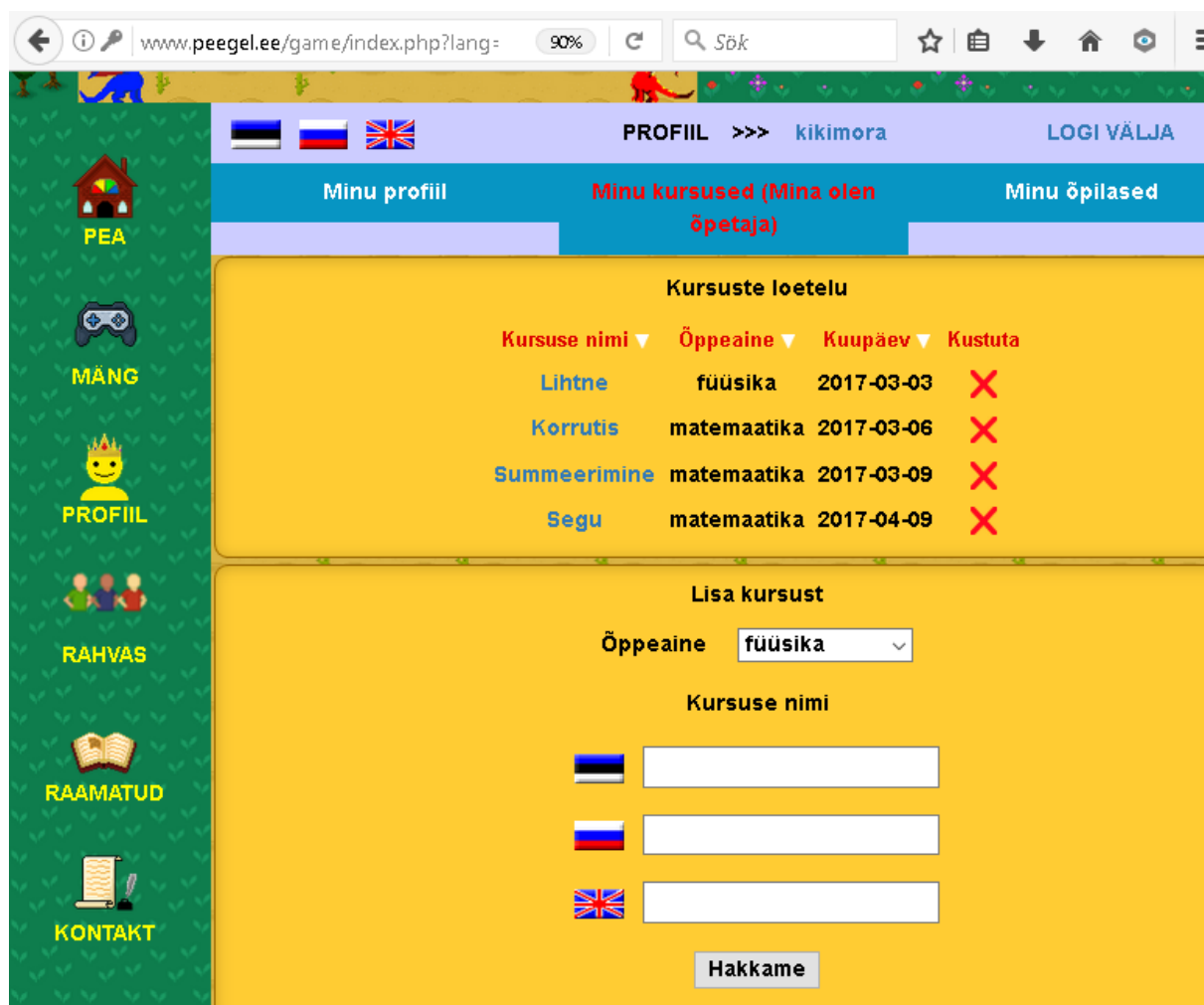


## 8. Process of work with the website for the teacher

The user wishing to work as the teacher can be registered at first as the ordinary user then to contact the site administrator.

It is necessary in order that the site administrator has put down to such user in the table *users* in the field of *admin* value “10” - it grants to the teacher the right to work as the moderator.

In mode of the moderator the teacher can create own courses (see Figure 8.1) and create accounts for the scholars – Figure 8.2. Also he can look through results of passing of tests by the scholars - Figure 8.3.



The screenshot shows a web browser window with the URL `www.peegel.ee/game/index.php?lang=`. The page is in Estonian and is for a user named 'kikimora'. The user is logged in as a teacher ('õpetaja').

The main content area is titled 'Kursuste loetelu' (Course list) and contains a table with the following data:

Kursuse nimi	Õppeaine	Kuupäev	Kustuta
Lihne	füüsika	2017-03-03	X
Korrutis	matemaatika	2017-03-06	X
Summeerimine	matemaatika	2017-03-09	X
Segu	matemaatika	2017-04-09	X

Below the table is a form to create a new course, titled 'Lisa kursust' (Add course). The form includes a dropdown menu for 'Õppeaine' (Subject) set to 'füüsika' (Physics), a text input field for 'Kursuse nimi' (Course name), and three radio buttons for selecting the language: Estonian (Eesti keel), Russian (Venemaa keel), and English (Inglise keel). A 'Hakkame' (Start) button is at the bottom of the form.

Figure 8.1. Page of creation of courses

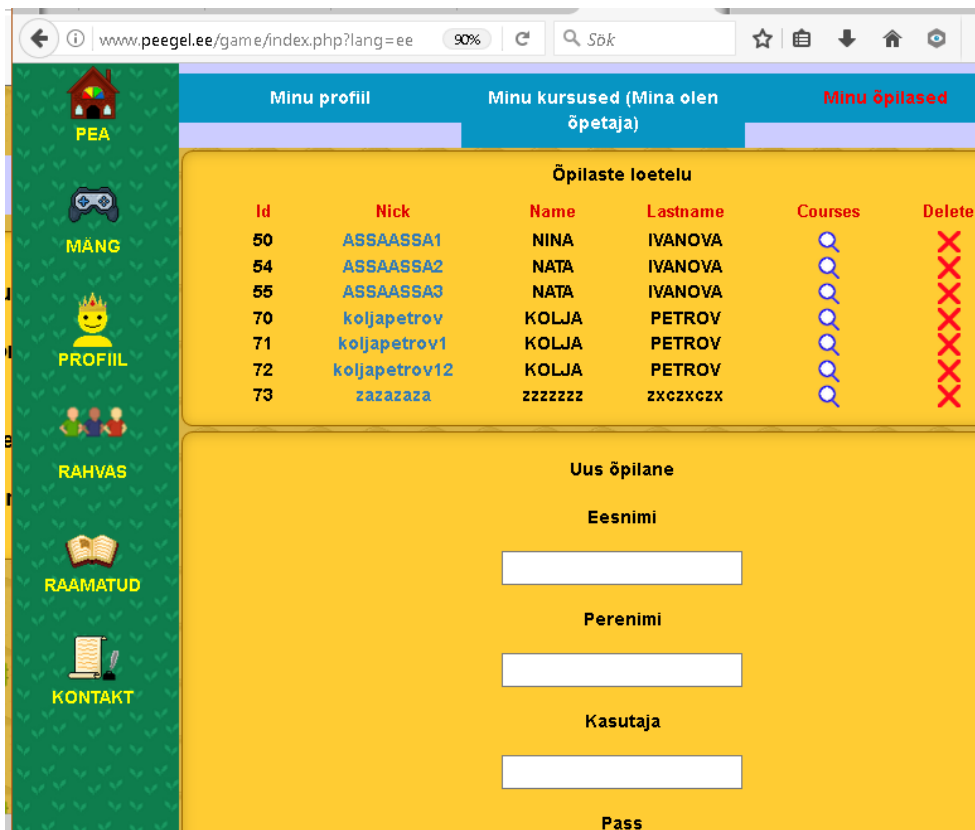


Figure 8.2. Page of creation of scholars accounts

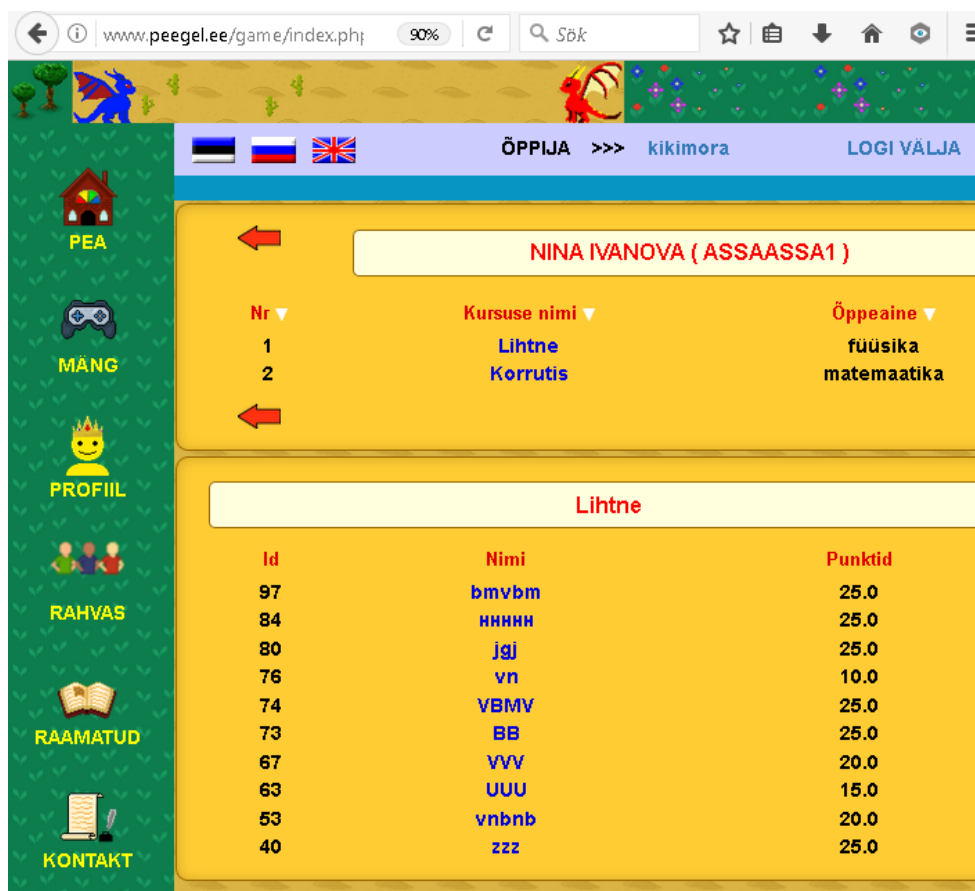
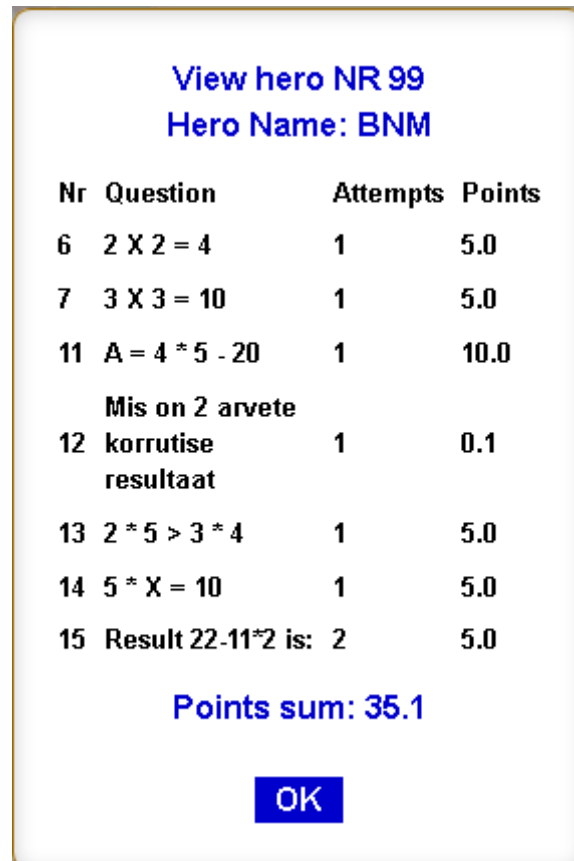


Figure 8.3. Page of view of scholars accounts

## 9. Process of work with the website for the scholar

After the teacher has created accounts for school children, he can give them their user names and passwords. If a student comes in with this username, he can see only the course that the teacher signed him in the list of courses. After passing the test / game, the student can see the test results on the subpage of MyHeroes. Moreover, incorrect responses are also recorded in the results table:



Nr	Question	Attempts	Points
6	$2 \times 2 = 4$	1	5.0
7	$3 \times 3 = 10$	1	5.0
11	$A = 4 * 5 - 20$	1	10.0
<b>Mis on 2 arvete</b>			
12	korrutise resultaat	1	0.1
13	$2 * 5 > 3 * 4$	1	5.0
14	$5 * X = 10$	1	5.0
15	Result 22-11*2 is: 2		5.0

**Points sum: 35.1**

**OK**

Figure 9.1. Result of test

In addition, the student still has the opportunity to switch to a simple user mode and to believe in school mode.

## Conclusion

As a result of the work, some working site-framework was created for further use and expansion. Many functions I would like to add.

## References and sources, books

1. A. Skonnard, „5 Top Trends in Education Technology 2015”, <https://www.inc.com/aaron-skonnard/5-top-trends-in-education-technology-2015.html>
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3. <http://www.mysql.com> – MySQL documentation
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5. Д. Н. Колисниченко, “Самоучитель PHP“, изд. 3-е (Наука и Техника, Санкт-Петербург, 2006)
6. Д. Чаффер, К. Шведберг, “Изучаем JQuery 1.3“, (Символ, Санкт-Петербург, 2010 )