CSRP-system design technology of training information support of competent professionals
The objectives

• The main purpose of this system is to increase the demand for future specialists in the labor market due to the dynamic integration of employer requirements and comprehensive support for all stages of the educational process
CSRP systems (Customer Synchronized Resource Planning)
To implement the CSRP-Systems in an educational institution it is necessary:

• to optimize the activities of the educational institutions, building an effective information infrastructure;
• to integrate the representatives of the real sector of economy into the divisions of the organization, aimed at servicing these customers (who plan and conduct training);
• to create the technological infrastructure by implementing open technologies capable to support the integration of employers, educational institutions and training control applications.
The objectives of the use of CSRP technology in education

- Creating human resource capacity for the Smart Region
- Improve the quality of graduates
- Reduce the time of preparation of the necessary specialists
- To reduce the cost of getting professionals with the necessary competencies
- Reduce the amount of paper documents
The process of creating dynamic educational programs which allows to get the right number of specialists with the desired competencies
The main objective of the development of a new generation of educational programs using the competency approach - to ensure compliance with the basic social problems of higher education - graduates in demand of the national economy on the qualifications and number
Stage 1. Formation and formalization of requirements of the employer to appropriate specialists
The relationship between competencies and requirements of the employer
The notion of ontology

Ontology - a clear and formalized definition of the structure of a problem area (theme).

Consists of entity classes domain, the properties of these classes of relations between these classes and assertions constructed from these classes, their properties and relationships between them.
Ontology professional requirements for High Performance Computing Systems Administrator
**FSES SELECTION SUBSYSTEM**

**ADDING SPECIALTY**

**SELECTING COMPETENCIES**

**UNMET COMPETENCE**

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<table>
<thead>
<tr>
<th>Направление</th>
<th>Процент удовлетворенности</th>
<th>Неудовлетворенные компетенции</th>
</tr>
</thead>
<tbody>
<tr>
<td>230100</td>
<td>27.27272727272727 %</td>
<td>-способность проводить выбор исходных данных для проектирования</td>
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<tr>
<td></td>
<td></td>
<td>-способность проводить моделирование процессов и систем</td>
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<td>-способность проводить расчет обеспечения условий безопасной жизнедеятельности</td>
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<td>-готовность участвовать в работах по доводке и освоению информационных технологий в ходе внедрения и эксплуатации информационных систем</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-способность использовать технологии разработки объектов профессиональной деятельности в различных областях</td>
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<tr>
<td></td>
<td></td>
<td>-способность участвовать в постановке и проведении экспериментальных исследований</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-способность оформлять полученные рабочие результаты в виде презентаций, научно-технических отчетов, статей и докладов на научно-технических конференциях</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-готовность обеспечивать безопасность и целостность данных информационных систем и технологий</td>
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<th>Неудовлетворенные компетенции</th>
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</thead>
<tbody>
<tr>
<td>230400</td>
<td>23.529411764705 %</td>
<td>-разрабатывать компоненты программных комплексов и баз данных, использовать современные инструментальные средства и технологии программирования</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-участвовать в настройке и наладке программно-аппаратных комплексов</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-инсталировать программное и аппаратное обеспечение для информационных и автоматизированных систем</td>
</tr>
</tbody>
</table>
Stage 2. Designing of the model of specialist competences required to employers
**Stage 3.** Identify the closest to the model developed federal government standard of higher education;

**Stage 4.** Determine the structure of the missing competencies;

**Stage 5.** Carry out the design of the curriculum is closest to the competence model training areas;

**Stage 6.** If necessary, carry out the design for the formation of the missing competencies of academic disciplines and to determine their complexity;
The process of formation of the competences

1. Identification and description of the original (current) student's competence - their knowledge, skills and ability to apply them to solve practical problems.

2. \( K_{ФГОС} = \{K_{ФГОС} \mid i=1,2\ldots n\}; \)

2. Description competencies required - specifies the knowledge, skills and abilities that learners must acquire.

\( K_{раб} = \{K_{раб} \mid j=1,2\ldots m\}, \) where \( j \) - Number of seats employer.

\( K_{тр раб} \cdot K_{раб} = K_{проф стандарт} \cup K_{тр раб}; \)
The process of formation of the competences

3. Planning a sequence of presentation of educational material - basic training program, in accordance with the current competence of trainees.

\[ K_n = K_{ФГОС} \cap K_{раб_к}, \]

where \( K_n \) - set of competencies areas of training that meet the requirements of employers.
The process of formation of competences

4. Control of the formation of competencies and correct formation of the current competence of the trainee:

\[ \Delta_j = K_{раб j} \setminus K_{ФГОС i} \]

Necessary to solve the optimization problem, aiming at minimizing the selection and training areas closer to satisfy the maximum number of competencies from a variety of \( K_{раб j} \):

\[ \Delta_j = (K_{раб j} - K_{ФГОС i}) \rightarrow \min \]

If:

\[ \Delta_j \leq \text{НРК} + \text{ДВС} \]

Training is carried out according to the educational program

\[ \Delta_j \geq \text{НРК} + \text{ДВС} \]

Within the framework of supplementary education courses are formed, covering the remainder of the uncovered competencies:

\[ \Delta_{курс} = \Delta - (\text{НРК} + \text{ДВС}) \]
Stage 7. Developing systems training and methodological support to add or change disciplines
OBJECTIVE APPROACH TO DEVELOP LEARNING OBJECTS

The diagram illustrates the objective approach to develop learning objects. The diagram shows the relationship between different components of learning objects, including:

- **Учебный материал** (Educational Material)
- **тип объекта** (Type of Object)
- **фORMAT объекта** (Format of Object)
- **имя автора объекта** (Name of Object Author)
- **имя владельца объекта** (Name of Object Owner)
- **сроки распространения объекта** (Object Distribution Timelines)
- **Метаданные: char** (Metadata: char)
- **включение объектов в логически упорядоченные последовательности элементов учебного материала() : void**
- **конвертирование** (Object conversion)
- **количество и состав отдельных объектов** (Number and Composition of Individual Objects)
- **уровень подготовки ученика** (Student Preparation Level)
- **взаимодействие преподавателя с учеником** (Teacher-Student Interaction)

The diagram also includes a note in Russian:

- Создаются для выработки у обучаемых новых качеств, способствующих эффективному применению полученных знаний, навыков и умений, т. е. формированию новых личностных характеристик.

The diagram is a visual representation of the objective approach to develop learning objects, highlighting the integration of various elements to achieve educational objectives.
8 stage. Provide information support curriculum change: display changes in the learning management system, the site of the university, the schedule, etc.;
Stage 9. Substantiate and develop criteria for evaluating the effectiveness of employers to develop the necessary professional competencies in students professionals and experimentally test them in the operation of the modified curriculum.

Carried out on the basis of statistical data on the status and results of the individual achievements of students. Aimed to check whether the knowledge on certain subjects taught in the curriculum, and skills for their use in typical situations. Are used:
- procedures for licensing of educational institutions,
- psycho-diagnostic studies,
- physiological monitoring,
- monitor the development of the regional education system,
- procedures of examination and certification.
# Development of a system of modules

<table>
<thead>
<tr>
<th>Modules</th>
<th>Purpose</th>
<th>State</th>
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</thead>
<tbody>
<tr>
<td>FSES selection</td>
<td>Formation and formalization of requirements of the employer to appropriate specialists</td>
<td>Ready</td>
</tr>
<tr>
<td>Competency model generation</td>
<td>To optimization of competency model</td>
<td>In developing</td>
</tr>
<tr>
<td>Learning objects preparation</td>
<td>Developing systems training and methodological support to add or change disciplines</td>
<td>80% ready</td>
</tr>
<tr>
<td>Dynamic curriculum change</td>
<td>display changes in the learning management system, the site of the university, the schedule, etc.</td>
<td>Partially ready</td>
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