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«Национальный исследовательский университет «Высшая школа экономики»

Факультет компьютерных наук
Департамент программной инженерии

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И.В. Аржанцев

Утверждаю
Руководитель Департамента программной инженерии
С.М. Авдошин

Рекомендована Академическим Советом образовательной программы
Рекомендованы Академическим Советом образовательной программы

Утверждаю
Академический руководитель образовательной программы
Д.В. Александров

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Course Information

Specification Author:
Elena Ovchinnikova, Associate Professor, PhD (Psychology), Deputy Vice Rector

Subject Title in English:
Psychology of Software Development Team Management

1. Application Guidelines and Regulations

This specification presents a detailed description of the educational purpose, curriculum, and assessment methods for the discipline “Psychology of Software Development Team Management”. This course is delivered to master students of software engineering department, business informatics faculty, HSE. The specification was developed in accordance with the following standards and regulatory documents:


The specification is intended to be used as a source of information by:

- students and potential students;
- lecturers delivering lectures and conducting practical classes on the course or related disciplines;
- professional and statutory regulatory bodies when carrying out accreditation.

2. Course Objective

In the highly competitive software industry, improving the software development process can be critical to a company’s success. More specifically, improving a team’s productivity can save employers significant time and money. The main issues for software development team productivity are in the area of “soft” skills, psychologically based phenomena and peculiarities.

The objective of the Psychology of Software Development Team Management course is to develop professional competencies, related to applying best practices of applied psychology to real situations, process of communication and management of software development teams.

Today the demand is growing for software development experts capable of analyzing problems, making decisions in business situations that involve risk or uncertainty, and building effective and efficient communication into and outside the team. These skills can be acquired through systematic studying of various team management incidents - cases. The curriculum is built so that the students immediately learn to use theoretical knowledge in practice by studying various team management incidents, identifying mistakes of people involved in the stories, and proposing problem solutions.
3. Learning Outcomes

During the course, the students will:

- Study the basic terms, definitions and principles of psychology regarding the team management (including software development teams);
- Master methods and tools for planning, control, arrangement, motivation, and communication in team working assignments;
- Master models of team management and forming effective and efficient teams (including cross-cultural, dispersed, virtual, and inter-disciplinary teams), assuming roles of the end user, software engineer, senior architect, CIO, and company chairman;
- Acquire practical skills in managing teams of software developers;
- Acquire practical skills in real-world decision making and problems solving in teamwork assignments.

The course contributes to the development of the following systemic and professional competencies [3]:

1. Project activities
   - The ability to arrange a multidimensional (including, crosscultural) communication and to manage it (СК-М7).
   - The ability to use the social and multicultural differences for problem solving in professional and social activities (ПК-3 СЛК-М3).
   - The ability to work in multidisciplinary team, including the international environment (ПК-9 СЛК-М9).

2. Managerial activities
   - The ability to plan and manage the process of software development (ПК19 ИК-М5.1.ПТД_ПИ1 (ПИ)).
   - The ability to arrange and manage the joint work of software development team, interact with counterparts (ПК-25 ИК-М7.3.ОУД (ПИ)).

4. Discipline in the Educational Program

Curriculum:

The course length is 190 academic hours, including 18 hours of lectures, 22 hours of practice and seminars, and 150 hours of self-study. Academic control forms are one home assignment and one test. It is a part of specialized curricula unit, and it is delivered in modules 1-2 of the second academic year. Number of credits is 5.

Prerequisites:

The course is based on the knowledge of foundations of psychology (general, cognitive, social, organizational), group dynamics and communications in professional practices.
Subject Structure and Contents

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic name</th>
<th>Course hours, Total</th>
<th>Audience Hours</th>
<th>Self-study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lectures</td>
<td>Practical studies / seminars</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Module 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Introduction to the course. Psychological aspects of software development team management</td>
<td>14</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>Psychological characteristics and personality types in software development teams.</td>
<td>26</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Team roles vs. functional roles in software development teams.</td>
<td>24</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4.</td>
<td>Team design and development.</td>
<td>14</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>Managing software development virtual and distributed teams.</td>
<td>24</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Total:</td>
<td>190</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Module 2</td>
<td></td>
<td></td>
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<tr>
<td>6.</td>
<td>Managing software development multicultural teams.</td>
<td>24</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>Managing agile software development teams.</td>
<td>13</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>Management and leadership in software development teams.</td>
<td>24</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>HR-aspects of software development team management.</td>
<td>14</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>10.</td>
<td>Software development team management in organizational context.</td>
<td>13</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

5. Grading and Assessment

<table>
<thead>
<tr>
<th>Type</th>
<th>Form</th>
<th>2 year</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progress check</td>
<td>Written test</td>
<td>*</td>
<td>45 minutes</td>
</tr>
<tr>
<td></td>
<td>Homework assignment</td>
<td>*</td>
<td>Case study development in team</td>
</tr>
<tr>
<td>Final check</td>
<td>Written exam</td>
<td>*</td>
<td>90 minutes – case study analysis</td>
</tr>
</tbody>
</table>
5.1. Evaluation criteria

Written test
Students get a written test with 45 minutes to complete. The test contains Yes-No questions, single-choice and multiple-choice questions, as well as open-ended questions. Students are scored based on the number of questions they answered correctly, and the weight of each question in the overall result (varies from 1 for single-choice and Yes-No questions, to 10 for open-ended questions). Evaluation formula is 10*(score_achieved/maximum_score). A maximum score of 10 can be achieved.

Homework assignment
Homework is in the form of case study development and analysis, providing in teams of 4-5 students. The topics and cases select by the student based on their interests. Once approval of the topic is obtained from course instructor, the student writes the case study based on the information from public sources, personal experience and imagination. Evaluation criteria for student’s homework assignment are presented in the table below. A maximum score of 10 can be achieved.

<table>
<thead>
<tr>
<th>Development of case study</th>
<th>Analysis of case study</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Relevancy of information</td>
<td>• Demonstration of good command of theoretical knowledge</td>
</tr>
<tr>
<td>• Real-life story basis</td>
<td>• Ability to identify both common and specific problems</td>
</tr>
<tr>
<td>• Structure of text</td>
<td>• Exploring various solutions</td>
</tr>
<tr>
<td>• Sufficiency of selected material</td>
<td>• Openness to different perspectives</td>
</tr>
<tr>
<td>• Freshness of ideas</td>
<td>• Being persuasive in argumentation</td>
</tr>
<tr>
<td>• Accuracy of problem statement</td>
<td>• Application of risk management principles and decision making</td>
</tr>
<tr>
<td>• Author’s contribution and analytical processing of information from public sources</td>
<td>methods</td>
</tr>
</tbody>
</table>

Written exam
Final exam is in the form of case study analysis. Cases are selected and assigned at random by the course instructor. Evaluation criteria for student’s homework assignment are presented in the table above. A maximum score of 10 can be achieved.

Penalties
Should plagiarism be identified in the student’s homework, disciplinary measures are applied as appropriate per the HSE Charter.
Should the student fail to present homework before the end of the 1st module, but submit it at any point during the 2nd module until the week of interim exams starts, a reduction of the scores for the assignment by 30% is applied. In this case, a maximum score of 7 for the homework assignment can be achieved.

5.2. Overall Score
Overall score on the course $O_{final}$ is determined using the following formula:

$$O_{final} = 0.2*O_{test}+0.3*O_{home}+0.2*O_{auditorium}+0.3*O_{exam}$$

where
- $O_{test}$ - score achieved by the student for the written test;
- **Ohome**: score achieved by the student for the homework teamwork assignment;
- **Oauditorium**: score achieved by the student for the participation in group discussion during the seminars and practical work in class;
- **Oexam**: score achieved by the student for the written exam.

A score of 4 or higher means successful completion of the course (‘pass’). A score of 3 or lower means failure to complete the course (‘fail’).

**6. Detailed Curriculum Plan**

**Topic 1: Introduction to the course. Psychological aspects of software development team management**

*Topic outline:*
- Course agenda
- Understanding programmers and software engineers, types of programmers
- Understanding ways of managing programmers and software engineers: why they seem to be unmanageable?
- Terms and groups, definitions and principles of psychological aspects of software development team management
- Framework for case study analysis

*Main references/books/reading:*
- Mantle, M.W., Lichty, R., *Managing the unmanageable: Rules, tools, and insights for managing people and teams*. Addison-Wesley, 2013. (Chapters 1, 2)

*Additional references/books/reading:*

Topic 2: Psychological characteristics and personality types in software development teams.

Topic outline:
• Understanding types of programmers and software personality
• Introduction to the personality theories
• Myers-Briggs Types (MBTI)
• The Keirsey Temperament Sorter
• Types of temperament
• Big Five Personality Dimensions
• DISC
• Types of reaction on conflict and on stress
• Soft skills vs. hard skills

Main references/books/reading:
• Briggs-Myers, I., Introduction to Type®, CPP, 1998.
• Mantle, M.W., Lichty, R., Managing the unmanageable: Rules, tools, and insights for managing people and teams. Addison-Wesley, 2013. (Chapters 1, 2 (p.27-28), 7)
• Hirsh, S.K., & Kummerow, J.M., Introduction to Type® in organizations, CPP, 1998.

Additional references/books/reading:

**Topic 3: Team roles vs. functional roles in software development teams.**

**Topic outline:**
- Functional roles in software development teams
- Functional programming departments and personality factors required
- Team roles (Belbin Self-Perception inventory)
- Developing the team roles in software developing teams
- Team profile in software development project

**Main references/books/reading:**

**Additional references/books/reading:**
- Stevens. K.T. The Effects of Roles and Personality Characteristics on Software Development Team Effectiveness, Dissertation submitted to the Faculty of Virginia Polytechnic Institute and State University, March 1998.
**Topic 4: Team design and development.**

*Topic outline:*
- Types of teams
- Team composition
- Team size
- Team forming
- Stages of team development (Forming-Storming-Norming-Performing)
- Criteria of team effectiveness

*Main references/books/reading:*

*Additional references/books/reading:*

**Topic 5: Managing software development virtual and distributed teams.**

*Topic outline:*
- Specifics of work with geographically distributed and virtual teams
- Virtual communication
- Managing virtual environment
Main references/books/reading:


Additional references/books/reading:


Topic 6: Managing software development multicultural teams.

Topic outline:

- Multiculturalism in IT, culture differences
- Multicultural model (Hofstede), culture specifics
- Specific problems and team management peculiarities
- Generation styles
- Cross-functional teams

Main references/books/reading:


Additional references/books/reading:


• Nicholson, B. and Sahay, S. Some political and cultural issues in the globalisation of software development: Case experience from Britain and India. Information and Organization 11, 25–43. 2001.


**Topic 7: Managing agile software development teams.**

*Topic outline:*
- Kanban, Extreme, Pair-programming and other agile practices from psychological view
- Psychological aspects of SPI models in agile software development

**Main references/books/reading:**


**Additional references/books/reading:**


**Topic 8: Management and leadership in software development teams.**

**Topic outline:**

- Management vs. Leadership roles, functions, behavioral patterns
- Management and leadership issues in software development
- Competency model for managers and leaders in software engineering

**Main references/books/reading:**

- Mantle, M.W., Lichty, R., Managing the unmanageable: Rules, tools, and insights for managing people and teams. Addison-Wesley, 2013. (Chapters 5, 6)
Additional references/books/reading:


**Topic 9: HR-aspects of software development team management.**

**Topic outline:**

- HR-issues in software development team management: selecting, attracting, assessing, retaining, developing, succession planning
- Finding and hiring great programmers
- Preparing to the interview
- Getting new programmers started off right: on-board recommendations, “first-day” musts
- Motivational aspects of computer personnel management
- Motivating programmers: motivational theories, motivational factors applied to programmers, key motivating factors

**Main references/books/reading:**

- Mantle, M.W., Lichty, R., Managing the unmanageable: Rules, tools, and insights for managing people and teams. Addison-Wesley, 2013. (Chapters 3, 4, 6, 7)

**Additional references/books/reading:**


Topic 10: Software development team management in organizational context.

Topic outline:
• Organizational psychology in context of software development team management
• Interacting with other teams on different organization levels
• IT-leaders in top management of organization
• Establishing a successful programming culture

Main references/books/reading:
• Mantle, M.W., Lichty, R., Managing the unmanageable: Rules, tools, and insights for managing people and teams. Addison-Wesley, 2013. (Chapters 5, 8)

Additional references/books/reading:
7. Educational Methods and Technologies

Case studies are stories with educational message [4]. Case study method was introduced in the beginning of 20th century in Harvard Business School primarily for development of analytical and problem-solving skills among training lawyers and managers. The case study method used at practical classes:

- makes the learning process interactive and entertaining;
- contributes to the development of analytical skills;
- encourages active use of theoretical knowledge;
- allows for students to feel at real-world situation;
- is adaptive to students level and background;
- admits both teamwork and independent work;
- imposes minimal requirements to laboratory equipment.

Educational institutions in the US and Europe are actively working on adopting this innovation into the educational practice of teaching psychological aspects of software development team management. Case study analysis was enlisted in among the skills that students at both undergraduate and graduate levels should embrace as a professional in team management. In this course we use a framework of methods, tools and taxonomies for analysis of case studies in managing software development teams. This framework allows students to study every situation in a formal rather than ad-hoc way, and apply a wide range of threat modeling, risk analysis and project management techniques in close to real life conditions.

a. Recommendations for course instructors

A big problem that an educator faces when using case studies for teaching psychological aspects of software development team in higher school is the lack of ready-made materials available for free use, apart from "product success story" case studies presented on web sites of a few companies for advertisement purposes. Sometimes teacher should collect or model relevant story from scratch or invite examples of cases from the audience.

b. Educational guidelines for students

Students will benefit from reading the sources listed in Section 7 and by active participating in simulations of real teamwork in classes.

8. Assessment Methods

Written test
The written test is a computer testing assessment based on the topics covered in the course (see Section 5 for the list of topics).

Written Exam
Student is assigned a case study related to one of the course topics.
9. Learning Resources

a. Course reader and main book(s)

b. Main literature
- Stevens, K.T. The Effects of Roles and Personality Characteristics on Software Development Team Effectiveness, Dissertation submitted to the Faculty of Virginia Polytechnic Institute and State University, March 1998.

c. Additional literature
- Mentioned above after each topics outlines.

10. Special Equipment
Lectures, seminars, and practical studies are conducted in a classroom equipped with an overhead projector and audio portables.

11. References

The author of the program: Ovchinnikova E.