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CONTENTS

Cont. on Next Page

***Reviewers for this Issue*:** Refer to pages **829-839** of this Issue.
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Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

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Main stages of preparing graduates for intellectual property management

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The relevance of the study is due to the necessity to create an approach that concentrates best practices in the organisation of training and develops a general concept of preparation of programmers for intellectual property management. In this regard, this article is aimed at developing principles for the organisation and content of theoretical and practical training in intellectual property management (IPM), taking into account the continuity of training programs, the integration of professional training in the speciality and preparation for IPM. The leading approach to the study of this issue is modelling, which allows comprehensively considering this issue as a process of purposeful and informed mastery of intellectual property management skills by specialists. The article analyses the subject content of work programs for courses included in the methodological system in the direction 02/09/03 "Programming in computer systems", as well as psychological, pedagogical and methodological literature on engineering specialties. The principles of curriculum design were presented, as well as a unified structure of the system of training programmes for IPM was revealed. The materials of the article are of practical value for preparing programmers for IPM and reflect all the essential components that contribute to the realisation of the goal to train programmers for IPM.

Keywords: student training, intellectual property management, structure of education, educational process, training

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INTRODUCTION

The implementation of the approach to ensure the high quality of preparation of graduates for intellectual property management (IPM) is possible, in authors' opinion, on the basis of a multi-stage system of the educational process aimed at mastering at each stage a specific, functionally complete set of theoretical knowledge and practical skills of IPM. The main objectives of such a system should be:

1. The development of motivation for activities in IPM, logical abilities and creative independence (Evdokimenkov et al. 2019a, Evdokimenkov et al. 2019b).

2. Formation of students' preparedness for IPM, which includes information, legal, economic and competencies in the field of IPM.

3. Ensuring compliance of the graduate's competencies with modern and perspective needs of the sphere of innovative production.

The achievement of the main goals should be facilitated by the solution of the main problem – the development of principles for the organisation and content of theoretical and practical training of IPM taking into account the continuity of curricula, the integration of professional training in the speciality and preparation for IPM (Aleksandrova et al. 2018, Niño-Amézquita et al. 2017, Aleksandrova et al. 2019, Babaytsev et al. 2019, Naumenkova et al. 2020, Nussipbekov et al. 2014, Orlov et al. 2003a, Orlov et al. 2003b, Orlov et al. 2001, Skvortsov et al. 2001, Skvortsov et al. 2009, Bulychev 2019a, Bulychev 2019b, Bulychev 2019c).

As the content of students training to develop competence in the field of IPM, educational material was used, obtained by integrating professional disciplines and socio-economic disciplines of the curriculum. Educational programs contain disciplines: "Social Psychology". The educational material of the discipline "Social Psychology" allows generating deep knowledge in the field of human psychology, to form the concepts of personality, subject, individuality; psyche and body; psyche, behaviour and activity; the main functions of the psyche; to form an idea of the structure of the psyche; basic mental processes, the structure of consciousness; cognitive processes; perception, representation, imagination of thinking and intelligence; creativity; attention; mnemonic processes; emotions and feelings; mental regulation of behaviour and activities (Koshoridze et al. 2017, Babaytsev & Zotov 2019, Koltunov et al. 2018, Kozorez & Kruzhkov 2019, Luhn et al. 2017, Skvortsov et al. 2015, Skvortsov et al. 2018, Skvortsov et al. 2016).

THE PRINCIPLES OF THE CONTENT OF THE PEDAGOGICAL SYSTEM OF PREPARATION FOR IPM

The following principles were put in the basis of building the structure of training and the content of the pedagogical system of preparation for IPM in the process of continuing professional education:

1. The principle of continuity, i.e. to provide the basis for continuous improvement and self-education (Skvortsov & Karizin 2017).

2. The principle of advanced education. The principles of selecting the content and methods of teaching activities in IPM should ensure the formation of modern ideas about

professional activity and the role of IPM in it, taking into account the prospects for the development of science (Skvortsov et al. 2014).

3. The principle of modularity. It allows structuring the content of training on the basis of a unity of goals and objectives, implementing differentiated training within each module, while maintaining inter-subject communications between the modules (Kozorez et al. 2015a, Luzgina 2017).

4. The principle of the applied orientation of training. Allows gaining experience of the IPM in the learning process (Babaytsev & Rabinskiy 2019).

In an educational institution, the content of education is the content of the educational process (Samokhvalova 2007). It is specified in a curriculum of an educational institution. The content of each discipline of the curriculum is specified in work programs. Based on the proposed structure of preparedness for IPM activities and on the basis of the above principles for the content selection, unified system of programmers training for IPM will be built (Avsievich 2012, Avsiyevich 2013, Nurutdinova 2018).

Traditionally, there are two components that meet the basic educational tasks – didactic and educational. The didactic component is reduced to designing the basic elements of the educational process and educational and program documentation (Vishniacova 2013, Nurutdinova & Panfilova 2019). The pedagogical model of the preparation system for IPM developed by the authors consists of two interacting and interpenetrating subsystems – the model of training a programmer in the selected qualification and the model of preparation for IPM (Sharifullina et al. 2020). The first subsystem – the vocational training model – is defined by the state educational programs of the corresponding direction of training. Therefore, this study is aimed at the development of the second subsystem – the model of preparation for IPM. Consider how the developed model works on the example of training technicians and programmers. At the University of TISBI, technical programmers graduate in the direction 09.02.03 "Programming in computer systems" (Rabinskii & Tushavina 2019, Amirgaliev et al. 2014, Čirjevskis 2017, Piwniak et al. 2007, Rabinskiy & Tushavina 2019a, Rabinskiy & Tushavina 2019b, Rimashevskaya et al. 2017, Sorokin & Novikov 2019, Kozorez et al. 2013, Krasil'shchikov et al. 2013).

The organisation of appropriate training of programmers for IPM requires the formation of an appropriate methodological base. The specifics of IPM training is that a subject of study itself is characterised by high dynamics, complexity, and is multidisciplinary (Ainoutdinova et al. 2020, Blagoveshchenskaya et al. 2020). To establish the sequence of studying subjects that form the basis of preparation for IPM, their relationship with subjects that comprise the content of professional training of an engineer, building a logical-structural training scheme, it is necessary to determine what types, methods, means of activity for IPM will be studied in the framework of the designed system (Vishniacova 2010). The next task is the development of curricula, the preparation of appropriate educational and methodological support, which would reflect the end-to-end training for IPM, the choice of teaching technologies (Aminova et al. 2015). The curriculum formulates the main goals and objectives. Curriculum design was based on the following principles (Bespalov et al. 2019, Borshchev et al. 2019, Krechetov et al. 2018a):

– scientific character of the choice of taught disciplines: the choice of disciplines aimed at forming preparedness for IPM is based on a deep and systematic analysis of the level and prospects of science development. There is a constant necessity to update the content of education by introducing discipline reflecting the current state of science into the curriculum (Daus et al. 2019).

– systemicity, which makes it possible to subdivide the final goal and the entire holistic educational process of preparing programmers for IPM into subsystems (modules) in the form of completed stages (Daus et al. 2018);

– integrity and completeness that allow representing the fullness of the structure and content of IPM process, adequately reflecting the integral structure and content of the advanced training of a programmer in accordance with the requirements of production, progress, economic situation (Davydenko et al. 2017);

– unity of functions, involving the concentration of educational, upbringing, production activities, forms of organisation, methods and means of training, ensuring regulatory support and participation of educational institutions for the main ultimate goal – the training of specialists able to successfully promote innovation and IPM (Dobrovolskienė et al. 2017, Formalev et al. 2019a);

– reproducibility, expressed in periodic updating of the designed system of vocational training for IPM, due to which continuous reflection can be achieved in the educational, instructional, production processes of preparing programmers for IPM changes that occur in the legislation on IP, in machines, in technology (Dobryanskiy et al. 2019a, Dobryanskiy et al. 2019b);

– integration focusing on the relationship and interaction of the stages of preparation for IPM; on the integration of educational; practical activities and forms of organisation methods and means of training adequate to them (Nurutdinova & Dmitrieva 2018);

– systematisation, that is, ensuring a rigorous and consistent systematization of the content of all stages of the system of preparation for IPM, which ensures its logical completeness (Formalev et al. 2019b);

– the continuity of the various stages by turning the process of training for IPM into the process of continuous development of a person by the methods and means of educational activities (Bulychev et al. 2019a).

Due to the fact that the time allocated for the formation of preparedness for IPM is limited, having analysed the range of tasks currently being solved by existing disciplines, the authors will determine their relationship and thus implement the general subject matter in the content of education (Shchepochkina 2017). As the content of the training, educational material was used, obtained by integrating engineering disciplines, humanitarian, social and economic disciplines of the curriculum (Babaytsev et al. 2017a, Babaytsev et al. 2017b, Berezovskii et al. 2015, Mustafin & Kantarbayeva 2018, Mustafin & Kantarbayeva 2019, Pietrzak et al. 2017, Pivnyak et al. 2013, Pivnyak & Shashenko 2015, Savon et al. 2019).

THE CONTENT OF THE SYSTEM OF PREPARING BACHELORS FOR IPM

The content of the system of preparing bachelors for IPM is presented in the form of modules: IP law, IP economics, patent law, intellectual property management. Each module is aimed at the formation of an appropriate competency. Based on the analysis of domestic and foreign experience in preparing programmers for intellectual property management, a foreign language discipline work program has been developed taking into account the requirements of the FSES (federal state educational standard) in the direction 09.02.03 "Programming in computer systems". According to the program, programmers study the terminology adopted in English in the field of information technology. The study of terminology in the field of information technology occurs through the study and translation of abstracts and descriptions of Russian patents into English. Patent documents contain information about the essence of inventions and use terms adopted in a particular field of knowledge. Students study the role and place of intellectual property in the activities of a programmer, doing technical translation (Golovchenko et al. 2018, Anamova et al. 2019, Kolesnik et al. 2019, Miriam & Radoslav 2017, Giedraitis et al. 2017, Hilkevics & Hilkevics 2017, Kasyanov et al. 2019, Khanagha et al. 2017, Krechetov et al. 2018b, Makarenko & Sorokin 2017, Metechko & Sorokin 2018).

Consider the module "IP Law" and how through the content of the module it is possible to form a legal competence in the field of IPM. Legal competence is an integral component of the professional training of an engineer, since law is both a branch of science and a field of practical activity, it is the unity of theory and practice. It allows acquiring not only knowledge, but also to develop abilities and practical skills of action, and legal regulation covers all areas of public life, where a person is the subject of many relationships: labour, family, intellectual property relations, etc. (Sorokin et al. 2019a, Sorokin et al. 2019b, Bulychev & Rabinskiy 2019, Astafieva et al. 2019). According to the State Educational Standards for educational specialities, educational programs contain the discipline "Legal support of professional activities" (Nurutdinova et al. 2018). The training material presented in this discipline allows generating deep and informed knowledge in the field of legal regulations for carrying out activities in accordance with the current legislation of the Russian Federation. The result of teaching is the formation of a stable level of legal culture of the future programmer, based on the letter of the law. Economic competence is necessary for the professional training of an engineer, since before starting development, an engineer must anticipate the economic consequences of his activities, namely: what positive economic effect he expects to receive from the introduction of an innovation, how much money will be spent on the implementation of an innovation, which of the options are preferable in this situation, etc. (Anisimov et al. 2017, Holovach 2015).

Educational programs contain the discipline "Economics". The educational material presented in this discipline allows mastering the basic concepts, methods and functions of economic theory; learn about the development of a market economy in Russia; cost-effectiveness mechanisms; the correlation of microeconomics and macroeconomics; about the principles of economic behaviour of subjects; forms of ownership in a market economy; about the features of the economic behaviours of firms in a competitive environment, etc. Discipline allows creating a deep and modern

economic thinking of a programmer focused on market reforms; recognition of the value of private business investment. Competence in the field of intellectual property management is important for the programmer. Before starting development, the programmer must anticipate the result and consequences of his activities, namely: which proposal is more attractive to an investor, how to present it to an investor; which of the options are more preferable in a current situation, etc. (Formalev et al. 2019c, Formalev et al. 2019d, Formalev et al. 2018, Grinyaev et al. 2019, Tabachenko et al. 2012, Voiskovskii et al. 2016, Yang & Černevičiūtė 2017, Kozorez et al. 2015b, Zavadskyi et al. 2020, Vlasova et al. 2016). The formation of knowledge about interpersonal relationships; psychologies of small groups; intergroup relations and interactions, teamwork mechanisms; on the essence of professional activity aimed at creating a workable, morally sustainable team; the development of value orientations for dialogue communication, coordination of interests of a team, personality; formation of qualities of susceptibility to innovation (Sabaeva & Nurutdinova 2020, Ainoutdinova et al. 2019). As a result of teaching the discipline, a student's culture is formed, possessing the skills of emotional and behavioural self-regulation and the qualities of an equilibrium personality, possessing the skills to coordinate the interests of an individual, organisations and society, characterised by a balanced style of decision-making and the ability to establish harmonious, positive relationships in a team, which generally contribute to the implementation of activities according to IPM (Antufev et al. 2019, Babaytsev et al. 2015, Barashkin & Samarin 2005).

The educational material of the discipline "Fundamentals of Economics" allows forming deep knowledge in the field of economic fundamentals of production and enterprise resources; fixed assets, working capital, labour remuneration, cost planning, technical and economic analysis of engineering solutions. There is also the formation of knowledge about the financial and innovative activities of enterprises: legal foundations, financial relations, taxation; fundamentals of enterprise management, technology development and management decision-making. Discipline makes it possible to build managerial skills, develops management decision-making skills based on technical and economic analysis (Ardalan et al. 2017, Krechetov et al. 2018c, Antufiev et al. 2018, Kurchatov et al. 2019, Rabinsky & Kuznetsova 2019). The content of multilevel preparation of students for intellectual property management includes interpenetrating stages. The first stage (1st year of study) – basic general educational disciplines of general humanitarian and natural science training are studied. At this stage, the understanding and explanation of the world. In the first year, the discipline "Foreign Language" is studied. Students learn terminology in a selected area of information technology when translating Russian patent documents. Students are aware of the role and place of intellectual property in the process of professional activity. The second stage (2nd year) – disciplines of law, planning and management, economics. Disciplines form the assimilation of the basic laws and rules of professional activity. The third stage (3rd and 4th years) – during this period, a block of general professional disciplines is studied, which allows forming a general professional representation of the sphere of future professional activity. The fourth stage (3rd and 4th year) – a block of special disciplines and specialisations, which allows building professional knowledge. Fifth stage (4th year practical training and diploma design) – development of the final qualification work. During this period, an independent

IPM takes place when performing final qualification work, which includes conducting patent research on a topic of final work (Astapov et al. 2019, Belyavskii et al. 2019, Bulychev et al. 2019b, Strogonova et al. 2019, Krasilshchikov et al. 2014, Kuznetsova & Rabinskiy 2019).

CONCLUSION

The authors have analysed the subject content of work programs for courses included in the methodological system in the direction 09.02.03 "Programming in computer systems", as well as psychological, pedagogical and methodological literature on engineering specialties. From the totality of the well-known psychological and pedagogical concepts, pedagogical technologies, forms and methods of training, the ones that most fully meet the set tasks of preparation for the IPM, the level of preparedness of students, and also the requirements for pedagogical technologies were selected. The authors have analysed the current standards of higher education in the specified direction of training, which determine the duration of study and the federal component of the curriculum in the form of a list of cycles of disciplines indicating volumes – general humanitarian and socio-economic; mathematical and general scientific; general professional; special, including specialisation; electives. The new generation of SES was also analysed. The proposed model of a system for training programmes for IPM reflects all the essential components that contribute to the realisation of the goal to prepare a programmer for IPM.

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