

# Building an Extensible Symbiotic University-Enterprises Cooperation in Ukrainian Game Industry

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**Abstract.** This paper describes the current state, the process, and the attitudes of cooperation between Kherson National Technical University and game industry companies in the frame of Erasmus+ project “University-Enterprises Cooperation in Game Industry in Ukraine” (GameHub). The work on the project in Kherson National Technical University is reported in the paper. It covers monitoring of the competence profiles needed on the game industry market, creating necessary infrastructure and developing the relevant curricula, study programs, education resources, and organization of the feedback loop with game industry enterprises. One of the priorities is to equip students with soft competencies needed for game industry such as creativity and academic integrity. The paper also presents the actual cooperation results, which could be helpful for Ukrainian higher education sector to respond to current and future education needs because mutually beneficial and sustainable university-enterprises cooperation can achieve a better match between competence profile of university graduates and those required by game industry.

**Keywords:** Cooperation, higher education, gaming industry, infrastructure, curricula, competencies

## 1 Introduction

Current state-of-the-art of the game industry (GI) in Ukraine is dynamically developing and becoming attractive for many international game application development companies. Developing Ukrainian GI is stimulated by a wide spreading of computer games among children and young people, active using of computer games in education, mature computer game marketing with well-established methods of monetization. On top of it, Ukrainian information technologies (IT) sector is proved its ability to develop and promote software of high quality.

Even with all things considered, preparing specialists for GI in Ukraine is complicated by a deficiency of narrowly focused specialists such as graphic designers, content managers, storytellers, scriptwriters, sound designers, sound programmers, web-client programmers, sketchers etc. A majority of Ukrainian universities don't have necessary software and hardware to equip laboratories for training such specialists, as well as appropriate curricula and educational programs of courses related to the development

of competencies needed for the work in game development companies. There is a gap between educational supply and the demand of GI market. Needs of this market in Europe and in the Ukraine force the enterprises and the universities to cooperate for the purpose of overcoming the above-mentioned complexities on mutually beneficial conditions.

The higher educational system in Ukraine is traditional and conservative. The nature of the GI sector requires of Ukrainian university developing a new conception of computer game development education providing students with the solid technical knowledge and skills, at the same time enabling them to focus on the transversal components of computer game design. The practical experience may come from the cooperation between the university and national game industry.

Although Ukraine has legislation and strategies for university-business cooperation improvement, in many cases these strategies are not implemented. Mismatches between employers' needs and what universities offer lead to skill gaps and economic underperformance. Therefore, the number of engineers-graduates with the competencies that fit the game industry employee profiles is almost zero.

University-enterprise cooperation has been a subject of debates and a focus of attention for many years and is commonly defined as all forms of interaction between universities and enterprises for the reciprocal and mutual benefit. In recent years, it is being developed rapidly and markedly through implementing Erasmus+ projects in the Europe [1-3] such as "Integrating Entrepreneurship and Work Experience into Higher Education" (IE-WEXHE), "Embedding Entrepreneurship Education" (Triple-E), "European University-business cooperation" (UBC) and others. The European project "Integrating Entrepreneurship and Work Experience into Higher Education" (IE-WEXHE) is aimed at the integration of higher education and enterprises. The project assumes generating case studies of work-based learning involving four types of disciplinary sectors (hard-pure, e.g. natural sciences; soft-pure, e.g. humanities and social sciences; hard-applied, e.g. medicine and soft-applied, e.g. social work) covering work placements, traineeships, and entrepreneurship. A unique feature is an attention to Humanities for which the transition to the labor market is less transparent and mapped than other sectors. The project "Embedding Entrepreneurship Education" (Triple-E) has been designed with the objective to increase the proportion of University students acquiring an entrepreneurial mindset and engaging in early-stage entrepreneurial activity [4]. The project "European University-business cooperation" (UBC) is aimed at conducting a Europe-wide study on cooperation between universities and business. This study is the largest study ever undertaken on the topic of UBC in Europe [5].

The problem of university-enterprise cooperation has been insufficiently studied in Ukraine. As a result, over the past decades, we have seen a disconnect between Ukrainian education system and the labor market.

All above-mentioned problems have stipulated initialization of International Erasmus KA2 project "University-Enterprises Cooperation in Game Industry in Ukraine" (GameHub) aimed at maintaining University-Enterprises cooperation in Ukraine [6].

## **2 GameHub Project**

GameHub project is aimed at the construction of the infrastructure, which allows students to improve their skills and competencies needed to work in GI and intends cooperation between universities and enterprises. The paper dwells on such cooperation organized in Kherson National Technical University (KNTU), which is the member of the international consortium of GameHub project.

The work on the international project GameHub started in October 2015. The project is aimed at developing the methods of teaching the students, veterans of anti-terrorist operation (ATO veterans) and unemployed engineers the competencies and skills needed to create computer games.

The main tasks of the project are the following:

1. Developing the map of the competencies, which can determine a professional level in GI, as well as the instruments for monitoring the competence profiles [7-9];
2. Preparing the university staff;
3. Developing 18 bilingual learning modules.

GameHub consists of four main components:

1. Pedagogical component, which includes a methodology for learning the students, ATO veterans and unemployed people how to create game applications according to the developed modules;

2. Technological component, which includes creating and maintaining the work of game laboratory;

3. Methodological component;

4. Informational component, which involves providing communication between the main branches of GameHub members:

- teachers and trainees/students, unemployed people, and ATO veterans;
- university management / GI representatives and employers;
- scientists / scientific society.

The work on the GameHub project in KNTU started with monitoring of the competence profiles needed on the GI market in Ukraine, creating necessary infrastructure and developing the educational resources.

## **3 Goals and Objectives of GameHub Functioning in KNTU**

GameHub in KNTU is a necessary and essential tool for the creation and implementation of new educational programs on computer games development. GameHub is also a tool to overcome a gap between the insufficient technological infrastructure of the educational process and the demand of GI market with the help of developing the game learning laboratory that provides students with the entire scope of the necessary tech-

nical knowledge and skills. As a result, implementation of project results helps the students to overcome some discrepancy between the knowledge gained at the university and the actual demand in the labor market.

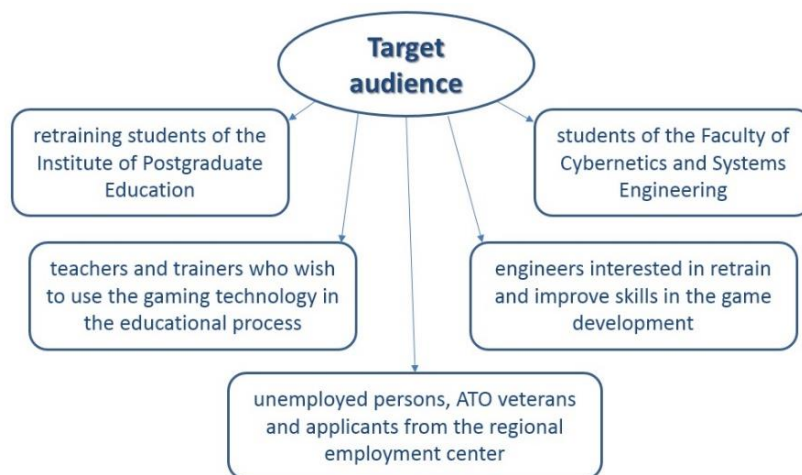
GameHub in KNTU should unify connections between the university, game industry and society in general.

The goal of GameHub is the stimulation of the students and trainees to acquire of knowledge and practical skills required for successful work in the computer games development sector.

The objectives of functioning GameHub in KNTU are:

- Providing conditions for creation and implementation of an innovative education program on computer games development as a specialization for the students of software engineering specialty;
- Adaptation of education program on computer games development to the GI market and employer's requirements;
- Increasing the level of quality of software engineering specialists through learning state-of-the-art technologies of computer games development at the level of labor market requirements;
- Looking for the ways to improve the organization as well as scientific and methodical ware of educational process;
- Providing consulting services to the base of university and game industry connection;
- Reciprocal exchange of experience, knowledge, educational materials and innovation practice of engineering education between partner universities.

The target audience of KNTU GameHub is illustrated in Fig.1.



**Fig. 1.** The target audience of KNTU GameHub

The principles of the GameHub organization in the University (fig.2):

- Close collaboration with enterprises in the area of game industry on the regional, national and international levels;
- Implementation of modern innovative educational methods and methodologies;
- Adaptation of educational program to the labor market requirements;
- Combination of studying the students with practical activity;
- Gamification of the learning process;
- Intensive collaboration with partner universities.

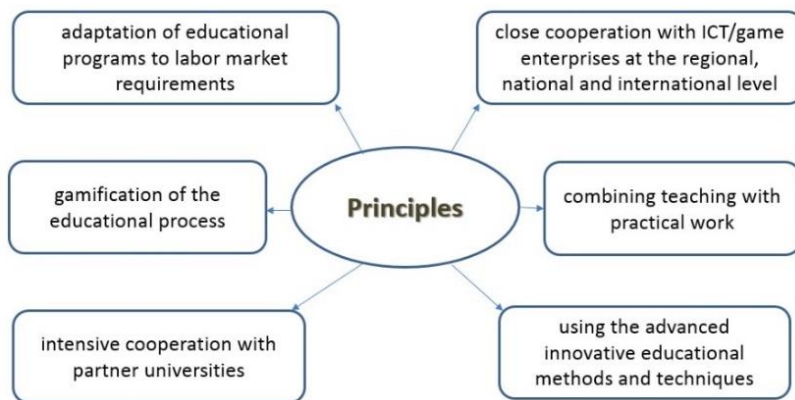


Fig. 2. Principles of GameHub in KNTU

#### 4 Priorities of KNTU GameHub

The priorities of KNTU GameHub are illustrated in fig. 3.

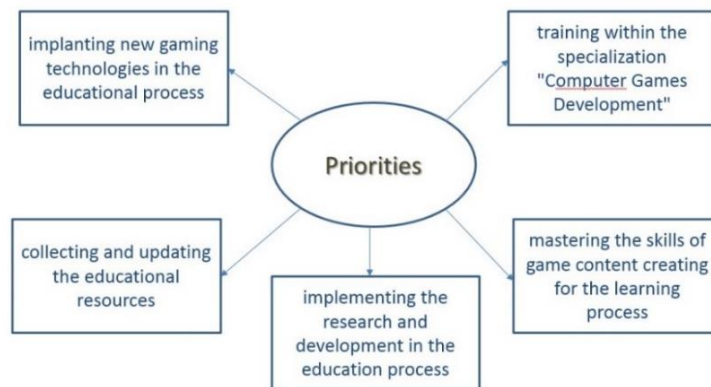
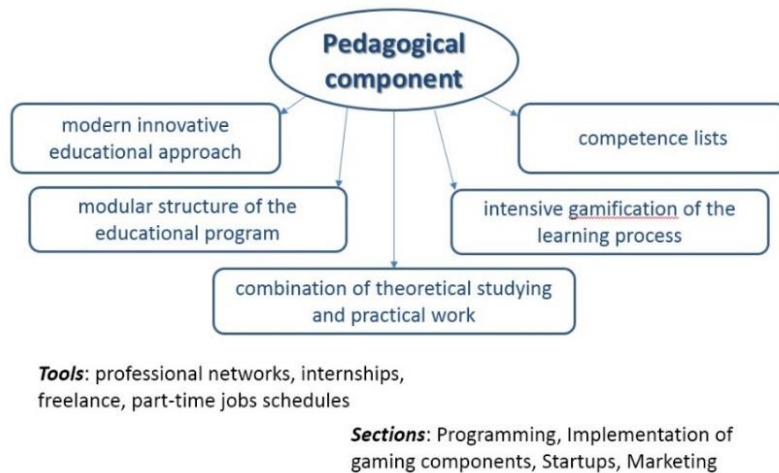


Fig. 3. Priorities of KNTU GameHub

All activities in KNTU within the project can be put into pedagogical, methodological, technological, informational, and academic components.

The *pedagogical component* (fig.4) of the GameHub project in KNTU includes the following stages:

1. monitoring the competencies needed for the GI market;
2. developing the competencies.



**Fig. 4.** The pedagogical component of KNTU GameHub

To monitor the competencies a thorough analysis of educational needs was performed using a survey among a wide variety of specialists, i.e. programming specialists (game-play programmers, user interface programmers, database programmers), design specialists (gameplay designers, mission/quest designers, user interface designers, scriptures), art specialists (texture artists, animators, environmental artists, cinematic artists, user interface artists etc.), audio specialists (audio engineers, music composers, musicians). The survey was conducted based on the pre-developed questionnaires [7-9]. The analysis of survey results has helped us to determine the employers' needs as to the main competencies of GI specialists.

The analysis of the competence level of the teaching staff and students majoring in "Information technologies" was also conducted.

The analysis of educational needs is based on questioning of 203 persons: 18 GI specialists from 5 game development studios and companies, 25 University teachers, 160 students.

In consequence of monitoring the competencies, we have determined a set of competencies needed for the students of specialties related to the GI to meet GI market demands, and have formed the competence profile of IT specialist in digital GI paying attention to the specific competencies that should be obtained by a specialist in this field [7].

Game developers tend to work in diverse teams that require more creativity and interpersonal communication skills than traditional software developers. The monitoring has shown that the main competencies for the game developer are creativity, academic integrity, problem-solving, teamwork.

Creativity appeared to be an especially important non-technical skill that could be enhanced in students headed for game development careers [10, 11]. It's what makes the games unique and competitive in a market. Creativity allows developing new ideas and coming up with the ways to hold consumers' attention.

Problem-solving is also important competence needed for game developers. All software, in general, is designed to solve some user problem and within that general solution is a wide array of smaller problems that make it up. Programmers are problem-solvers by occupation, which it is one of the most vital soft skills for success in the industry. After writing codes and creating programs, programmers also find and fix any issues that may appear. This is not often an easy task since even the tiniest of errors has the ability to wreak havoc on a program.

Ability to work in a team in many cases can be the first or most important skill for game developers. Games companies involve groups of people, working together, to achieve the same final goal. Game developers must be good communicators, who can cooperate with people working closely with programmers and receive feedback from testers ensuring that the functionality of the game is practical and balanced. Unless a game developer can effectively deal with other developers, managers, and even customers, he will constantly face trouble despite how good your ideas are or how valuable his skills are.

Another competence equally important for GI is academic integrity (AI) [12, 13]. Academic integrity means academic honesty and implies that students and teachers abide by a code of honesty, trust, fairness, respect, and responsibility related to the production, publication, assessment, and exchange of knowledge in learning, teaching, and research. Maintaining academic integrity is an issue of concern to all the students due to high and rising levels of plagiarism and other forms of cheating such as receiving unauthorized assistance. Courses related to computer programming require special consideration because they are connected with the intellectual property, and use of the computer permits easy copying and modification of programs. The accusation of AI by students has serious consequences in their future workplaces. In the workplace, since the profit of game developers and their employers depends upon the uniqueness and originality of the code, a plagiarism or stealing the code can potentially harm the career.

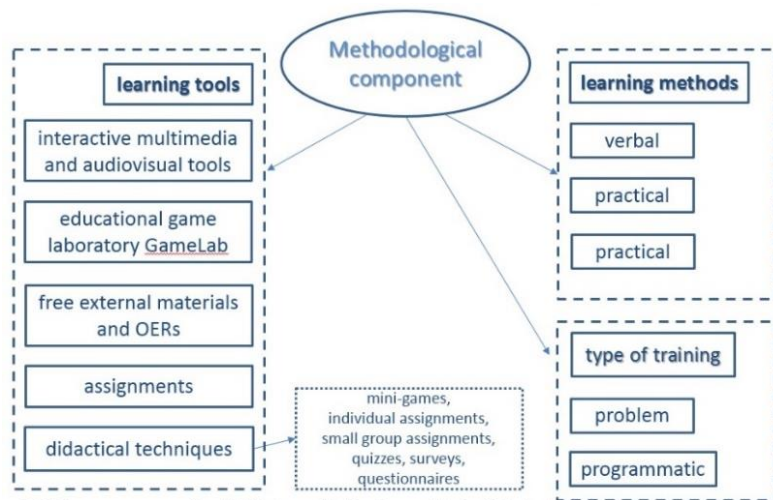
The analysis shows that the level of knowledge and skills of University students in Information technologies do not satisfy the requirements of employers in the field of CI. During the analysis, it has been also determined that the level of foreign languages, programming and graphics environment of the students and teachers should be improved.

The relevant curricula and programs should be created to develop or/and improve the detected competencies specialized modular courses. Curricula and programs should be based on the alliance of theoretical learning providing a certain system of knowledge with the practical work providing a system of necessary skills through the active im-

plementation of laboratory and practical tasks, training and work with potential employees, realization of creative ideas in the course works and graduation works, scientific work, taking part in startups etc.

To develop the competencies a learner-centered environment should be constructed, which is connected with some changes in practice. The first change relates to a switch from a perspective that the teacher is responsible for the learning to one that teachers and students share the responsibility for the learning. Working in small groups, when the students from each group have their own goals and work to achieve them, encourages students to take charge of their learning, trains their leadership skills. The second change relates to the content. The situation when teachers cover content and students acquire it should be substituted by using the content in the learner-centered classroom to construct knowledge. Active learning in the form of discussions encourage students to acquire an interest in learning by asking their own questions and seeking answers. In other words, students develop competencies needed by professionals by becoming active participants in the learner-centered environment.

The *methodological component* of GameHub (fig. 5) in KNTU is based on the experimental realization of the innovative educational program through the development of learning modules for university courses and providing them with necessary educational recourses.



**Fig. 5.** The methodological component of KNTU GameHub

The educational program has module structure that covers all levels of necessary knowledge and skills, such as programming (Python, JavaScript, Java programming languages), startups, marketing.

Teachers, who passed appropriate training, have developed learning modules in the form of open educational recourses focused on using methods and forms of blended learning for students (trainees) on the base of learning game laboratory GameHub. The



system of knowledge and skills provided by learning modules meet the developed profile of specialist's competencies.

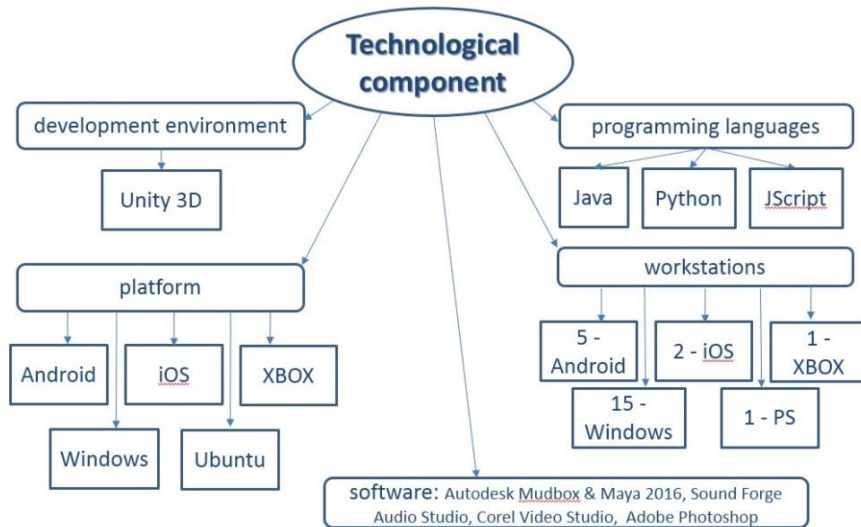
The content of learning modules is provided through the verbal (lectures and consultations), scientific (presentations) and practical methods (laboratory practicals), as well as through the intensive use of the method of project execution (performance of individual and group (in small groups) problem tasks).

The base of an educational process aimed at developing the necessary competencies is problem-based learning through a certain system of methods and tools, which form creative thinking and cognitive ability of students (trainees) through the solving of problem-based tasks in the area of computer games development and game content creation. Cognitive situations, according to which a student has a lack of available knowledge for practical situational tasks solving, are designed for this purpose.

Using programmed learning elements allows splitting learning material into certain portions, which fit in with specific elements of understanding, and by virtue of a problem task in each portion provides for individualization of learning with appropriate feedback and self-control in task performance.

Programmed and problem-based learning have a theoretical form of lectures and consultations and practical form of individual tasks and work in small groups.

The **technological component** (fig.6) includes creating and maintaining Game Learning Laboratory (GameLab).



**Fig. 6.** The technological component of KNTU GameHub

The equipment and software of game learning laboratory GameLab meet the requirements of developed learning modules and will be used for learning and training the students, the trainees and teachers according to the educational program “Computer games development”.

The *informational component* of the GameHub project in KNTU is aimed at wide dissemination of project results and involves providing information days, roundtables and job fairs.

The members of KNTU workgroup have organized information days for students that have been aimed at sharing the information about the goals of the project, as well as the opportunities for students in consequence of project realization in the university. The roundtables with potential employers and the students of Information Technologies department have been organized upon an initiative of the KNTU workgroup. Such roundtables are aimed at the development of partner relationships in University-IT-Enterprise format. One of such employers is Wezom web development agency that is a trustworthy website development and design company. Representatives of Wezom company have made aware the students of open vacancies in GI market, requirements to potential game developers. KNTU graduates who work for Wezom company have shared their working experience.

KNTU workgroup have also organized job fairs in Kherson Employment Centre, aimed at attracting certain target groups such as demobilized military, ATO veterans, resettlers from the Crimea and the eastern part of the Ukraine, as well as unemployed people to achieve professional competencies in the area of computer game design and development based on KNTU postgraduate centre.

The *academic component* of GameHub in KNTU (fig. 7) consists of:

1. an educational program on “Software engineering” specialty, “Computer games development” area of study, which is being renovated and improved permanently through the feedback from potential employers;
2. three learning modules, which are being developed by KNTU workgroup for implementation into the educational program on “Computer games development” area of study:
  - Computer games development using the Unity3d engine (Master’s degree, Bachelor degree),
  - Developing Game Web-applications (Master’s degree, Bachelor degree),
  - Network computer games development with Java (Bachelor degree);
3. Two learning modules which are being developed by KNTU workgroup for trainees of Institute of Postqualifying Education (including unemployment people, veterans of anti-terrorist operation):
  - Computer games development using the Unity3d engine,
  - Visual games programming;
4. Learning modules which are being developed by KNTU partners, including 15 learning modules for Bachelor or Master’s degree students and 5 learning modules for retraining of trainees, and which can be adapted for use in an educational program on “Computer games development” area of study in KNTU.

All learning modules have been created in accordance with the list of competencies resulting from the survey [7]. Each learning module has flexible structure and content,

as well as its online version. Flexible module's structure imposes several versions of content for target groups of different levels of skills and knowledge. The online version of each module is meant for learners of any age returning to education after a period of work, unemployment or ATO-veterans.

As a result of the project piloting, which is being conducted at the present time, we have gathered positive feedback from employers. They confirm that the learning modules provide the competencies, which are essential for the success of the students in the digital GI market.

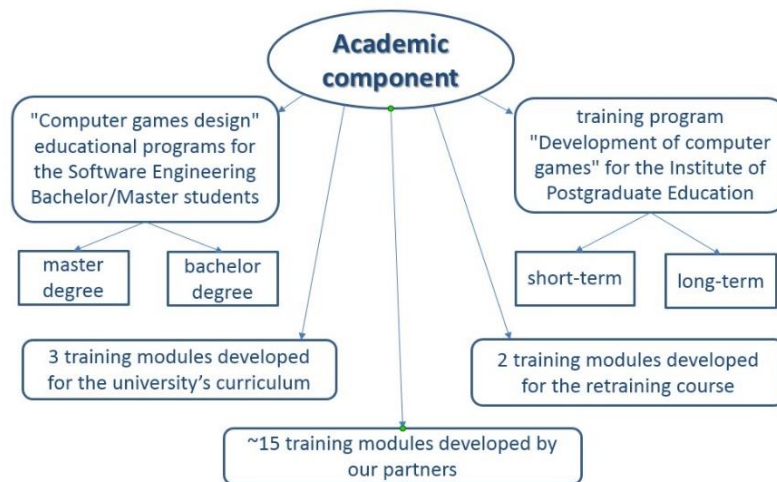


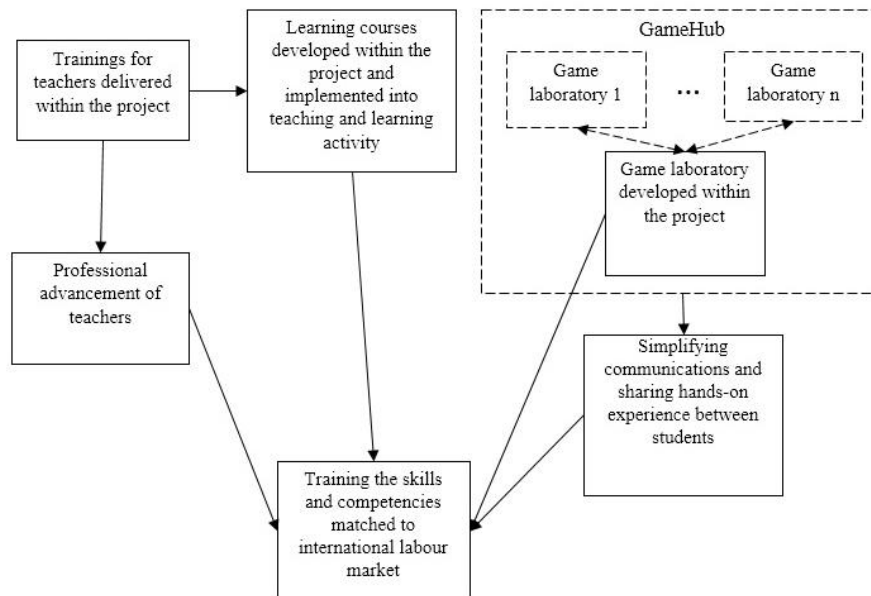
Fig. 7. The academic component of KNTU GameHub

## 5 Providing Project Sustainability

For providing GameHub sustainability [14,15] in KNTU some conditions have been created. They are as following (fig.8):

- GameHub learning laboratory provided with all necessary equipment and the staff for continued functioning is created;
- educational program on specialty “Program engineering”, specialization “Computer games development” is developed;
- the agreements for collaboration with potential employers on the regional and national levels in terms of regular updates of competence profiles of specialists in the area of computer games development are signed;
- the agreement for collaboration with regional Employment Service is signed. The agreement provides for retraining and advanced training of unemployment people, ATO veterans and engineers, who are interested in the game development work in the area of game development, according to the Educational Program “Computer games development” in the Institute of Postqualifying Education of KNTU on the base of game learning laboratory GameLab;

- the learning modules, which constitute the Educational Program on specialization “Computer Games Development” are transformed and delivered on the base of the game learning laboratory GameLab into the open educational resource with the open public access;
- the game learning laboratory GameLab is used for delivery of course and graduate works by students and trainees, individual and scientific research tasks, for providing experiments by teachers and scientists while performing scientific and thesis research in the area of computer games development;
- the training, providing of consulting services in the area of computer games development on the base of the game learning laboratory GameLab for a wide variety of interested physical and juridic persons on the commercial basis are delivered;
- the GameHub infrastructure is used for the further implementation of innovative educational and scientific projects, related to computer games, their development technologies and gamification of education.



**Fig. 8.** Sustainability vision of GameHub project at KNTU

Within the GameHub project KNTU collaborates with eight IT companies specialized in computer game development. The closest collaboration is established with Wezom Company and MetaSoft Inc. We collaborated with them to create profiles of competencies needed by game studios using the questionnaires specially made for this purpose. 35 GI representatives were interviewed and questioned. The respondents evaluated common (core) and specific (professionally-oriented) knowledge and skills, which are necessary for the digital game design employees.

Based on the requirements of the employees, the work plan for the preparation of computer game developers and a set of necessary courses in KNTU has been developed.

A set of learning modules within a frame of GameHub project is developed in each Ukrainian partner-university. In KNTU they are as following: Developing Game Web-applications, Computer Games Development with Unity 3D, Network Computer Games Development with Java, Visual Game Programming. The courses are in the process of accreditation. All modules are connected into Hub and will be accessible not only for the Partner Universities but for all interested people (Fig.9).

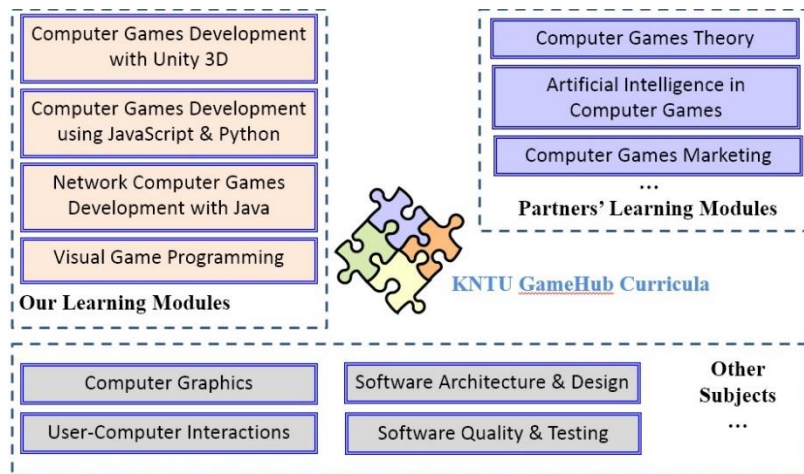


Fig. 9. KNTU Pilot Implementation: GameHub Curricula

To control and monitor the development of learning modules the pilot is being delivered (Fig.10). Approximately 180 University teachers, 500 students and 150 unemployed including ATO veterans are being trained. The final results of piloting are planned to be ready by the end of May, 2018.

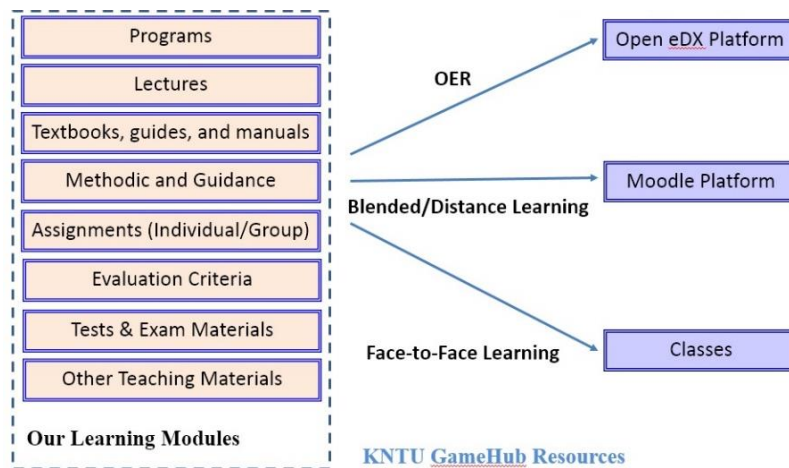
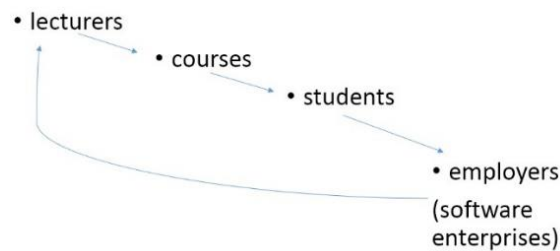


Fig. 10. KNTU Pilot Implementation: Preparing Stage

The implementation of the project allows preparing specialists in alignment with the demands of employees, which allow employees to save time for refresher courses and advances professional training of the graduates.

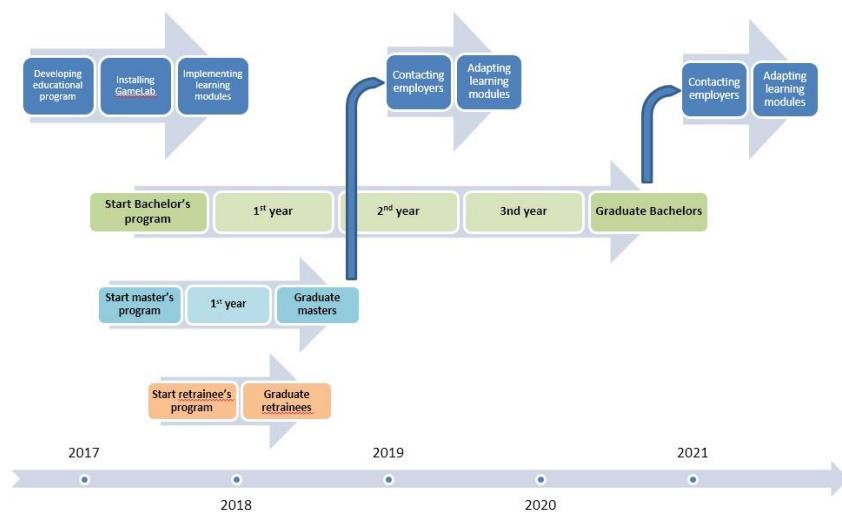
All Partner Universities are supposed to correct content of the modules based on the evaluation of using the modules in the educational process. This imposes realization of certain feedback loops, such as from industry expert after learning material preparation (Fig.11), from students after course finish, etc.



**Fig. 11.** KNTU GameHub educational feedback loop

Project sustainability is ensured by sustainable use of the game lab and GameHub learning materials as open educational resources within engineering curricula in the universities, as well as by incorporation the project results and outcomes in the professional training provided in education/training centers for unemployed people, ATO veterans, and other interested individuals.

The KNTU GameHub RoadMap is presented in Fig. 12. It shows the main stages of planned feedback from GI enterprises within the framework of university-enterprise cooperation.



**Fig. 12.** KNTU GameHub RoadMap

In order to establish exploitation of the project results, the GameHub continues to deliver and update the learning materials carried out by all trained teachers from Ukrainian Partner Universities during and after the project.

The mutually beneficial cooperation between Universities, small and medium-sized enterprises of the game business, and ATO veterans' associations established during the project will ensure GameHub further growth and exploitation fostering and investing into Ukrainian IT creative business sector.

## **6 Conclusions**

The results of GameHub project will be helpful for Ukrainian higher education sector to respond to current and future education needs because mutually beneficial and sustainable university-enterprises cooperation can achieve a better match between competence profile of university graduates and those required by GI. This will provide graduates with high-level, employable skills, as well as the transferable skills that equip graduates for a fast-changing labor market. Ukrainian graduates will meet the requirements of the international labor market and can enhance the integration of Ukraine into European IT sector.

## **7 Acknowledgment**

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