

Knowledge Absorption: Development Of An Educational Platform For Project-Based Learning

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Abstract—This article discusses the development of a digital educational platform for project-based learning. It is assumed that, when combined with other innovative approaches to enhancing the educational process, project-based learning, supported by digital tools, will enhance student knowledge absorption. The purpose of this study is to develop a concept for a project-based learning platform for students. To achieve this goal, the following tasks must be addressed: 1) examine the influence of student agency on knowledge absorption; 2) determine the role structure of project-based learning actors in the knowledge absorption process; 3) formulate a concept for a project-based learning platform for students. Theories of cognitive development and knowledge absorption, the rational construction of new forms of knowledge, and methods of sequential decomposition and synthesis of complex systems are used as the methodological basis. The main results of the study include an explication of student positions, the definition of agency as a student personality trait, the determination of the role structure of project-based learning actors, the development of an integrated knowledge absorption model, and the conceptual modeling of a project-based learning platform.

Keywords—project-based learning, knowledge absorption, subjectivity, subjective position, knowledge absorption model, educational platform

I. INTRODUCTION

Digital transformation has impacted universities. New challenges have emerged. University-business collaboration is essential [1] [2] [3]. This requires changes in the educational process. Specifically, students need to be empowered to take a subjective position: 1) take responsibility for learning outcomes; 2) acquire knowledge purposefully; 3) understand the urgency of developing hard, soft, and digital skills.

This will enhance knowledge absorption and ensure educational outcomes. Theory must be supported by practical application [4] [5] [6]. One option is student project-based learning. This will ensure the development of students' absorptive capacities. A digital tool must be developed to support project-based learning [7] [8].

The purpose of this study is to develop a concept for a digital project-based learning platform to enhance knowledge absorption. Achieving this goal requires: 1) assessing the impact of student agency on knowledge absorption;

2) identifying the roles of project-based learning actors; and 3) developing a platform concept. The study design is structured to consistently address these objectives.

In the first part of this study, we conduct a secondary study to examine the characteristics of knowledge absorption in project-based learning. In the second part of the article, we present a conceptual model of a project-based learning educational platform for enhancing knowledge absorption. The study utilized a systematic literature review on the selected topic, a systems decomposition method to design an integrated knowledge absorption model, and a rapid prototyping method to develop the conceptual model of the project-based learning educational platform.

II. STUDENT ATTITUDE AS A KEY FACTOR IN KNOWLEDGE ABSORPTION

Knowledge absorption is defined as a learner's ability to recognize the value of new information, assimilate it, and apply it to achieve their goals [8] [9]. External and internal factors influence absorptive capacity [10] [11]. External factors help manage the effectiveness and efficiency of the learning process. Internal factors include existing knowledge, individual ability to assimilate information, level of education, experience, etc. The term "student absorptive capacity" has been updated in recent years. It is now recognized that students' knowledge absorption capacity plays a central role in learning [12] [13].

The modern generation of students is characterized by heightened individualization and a total personalization of all aspects of their lives. Students are capable of interacting through any communication channel, actively sharing information and generating new information. This requires new approaches to interaction with the instructor and dictates new requirements for the material and delivery of courses. A negative assessment of instructor-student communication hinders knowledge absorption. Here, knowledge acquisition is replaced by the process of acquiring information in various subject areas. This precludes the possibility of knowledge appropriation and hinders the process of knowledge absorption. Thus, the student's subjective position determines their educational outcomes. Table 1 presents the components of the student's subject position.

Thus, a student's subjective position is the result of their self-determination, expressed in their constructive behavior during the acquisition of knowledge and their awareness of the urgency of investing their efforts in future professional success and well-being. One option for enhancing student subjectivity is project-based learning. It ensures the application of theoretical knowledge to solving practical problems.

TABLE I. MANIFESTATION OF STUDENT SUBJECTIVITY IN THE EDUCATIONAL PROCESS

Components of the Subject Position	Manifestation in the educational process
Learning Philosophy	Acquisition of knowledge (absorption) is the foundation of a free, thinking, and independent person
Constructivism	Acquisition of knowledge (absorption) is the basis for developing a holistic picture of the world
Engagement	The student's independent efforts in the process of acquiring knowledge (absorption) ensure academic success and educational outcomes
Proactivity	The student recognizes the urgency of investing their own efforts in acquiring knowledge (absorption)
Self-determination	The student understands that acquisition of knowledge (absorption) is the foundation of professional and social development

III. BEFORE ROLES OF PROJECT-BASED LEARNING ACTORS

Project-based learning provides clear project objectives and motivates students. Each project has a time limit for completion. Students are forced to work within a strict time constraint. This sense of urgency ensures that students complete project tasks and develop hard, soft, and digital skills. This ensures educational outcomes. Thus, project-based learning fosters student agency.

Project-based learning outcomes support digital tools. They connect groups of actors in the process of solving project problems. Each actor is assigned a role. Roles define the actor's functions within the project team. The functions of the actors are defined below:

- the project task is defined by the project customer (actor A1);
- the project is implemented by the project team – the project manager (actor A2) and students (actor A3);
- the project is supported by the project administrator (actor A4).

Our university's advanced digital environment provides digital support for actors. This tool is the "Intelligent Exchange" (actor A5).

The actors' work enables the project's goals to be achieved. Actors A1, A2, and A3 sequentially complete three stages of knowledge absorption. They create new knowledge through research (knowledge creation stage). Actors A1, A2, and A3 share their results with representatives of public and private organizations (knowledge dissemination stage). Together with actors A4 and A5, they collect, process, and store the acquired knowledge (knowledge absorption stage). The stages of knowledge absorption are decomposed into processes shown in Table 2.

An important function of "Intelligent Exchange" (actor A5) is the substantive analysis of tasks incoming from customers (actor A1), their possible refinement, and

adaptation. It is necessary to ensure that the level, depth, and content of tasks, as well as the expected results of their solution, correspond to the goals of the platform and its actors, as defined by the implementers—faculty and students. Furthermore, the university itself, interested in solving various tasks, may act as a customer. Tasks may be strategic or operational in nature.

TABLE II. DECOMPOSITION OF KNOWLEDGE ABSORPTION STAGES

Knowledge Absorption Stage	Stage Process	Actors
Knowledge Creation Stage	P1. Defining Research Priorities	A1, A3, A5
	P2. Generating Ideas	A1, A2, A3, A5
	P3. Selecting a Research Direction	A2, A3, A4
	P4. Implementing Project Work	A2, A3
	P5. Assessing Readiness	A1, A5
Knowledge Dissemination	P6. Registering Intellectual Property	A2, A3, A5
	P7. Evaluating Results	A1, A4, A5
	P8. Pilot Development of the MVP	A2, A3, A5
	P9. Promoting the MVP	A1, A2, A3, A4, A5
	P10. Signing the Agreement	A1, A2, A4, A5
Knowledge Absorption	P11. Registration of property rights	A2, A3, A4
	P12. Acquisition of new knowledge and competencies	A2, A3, A4
	P13. Exchange of best practices	A1, A2, A3, A5
	P14. Entry of young specialists with relevant competencies into the labor market	A3, A5
	P15. Value creation by exchange participants	A1, A2, A3, A4

Thus, the functionality of the actors (Table 1) is condensed into an integrated knowledge absorption model is shown in Figure 4. This approach is consistent with established knowledge transfer models [14] [15].

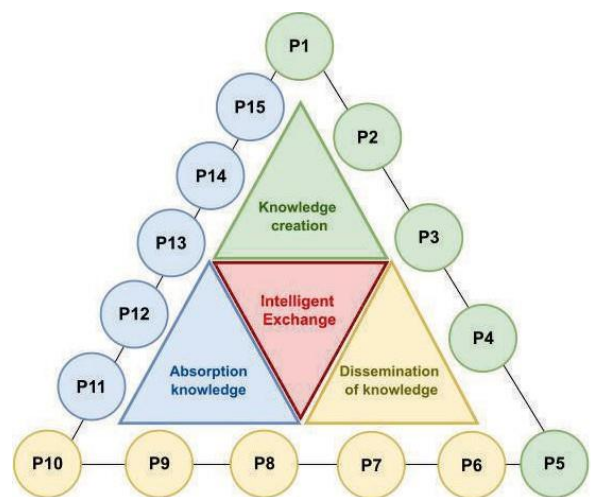


Fig. 1. Integrated model of knowledge absorption based on the educational platform of project-based learning.

The core element of the supporting structure is the project-based learning platform "Intellectual Exchange" (actor A5). It supports fifteen knowledge absorption processes. These processes are repeated cyclically at each new stage of knowledge absorption.

IV. A CONCEPTUAL MODEL OF A PROJECT-BASED LEARNING PLATFORM FOR ENHANCING KNOWLEDGE ABSORPTION

The use of modern information technologies opens up opportunities to accelerate the knowledge absorption process. This is achieved through the integration of specialized digital platforms into project-based learning.

The platform's web services reduce the labor intensity of managing and supporting project activities, creating and storing information about project tasks and client requests, completed projects, and their participants. These services support communication between learning process participants and help solve project problems.

The platform's functional specialization coordinates the actions of project teams and clients at each phase of the knowledge absorption cycle. The toolkits are presented in Table 3.

TABLE III. ROLE-BASED STRUCTURING OF PARTICIPANTS' REQUIREMENTS FOR THE PROJECT ACTIVITY PLATFORM AND ITS WORKING TOOLS

Actors	Requirements of actors for the project activity platform	Working tools of the project activity platform
Project Customer (Actor A1)	minimizing the time, it takes to establish contact with performers	-Web form for collecting requests; -Chat center; -Web form for customer responses; -Web form for contractor responses; -Web form for project managers; -Showcase of open tasks for contractors
Project Manager (Actor A2)	gaining maximum access to stored project information in real time	-Repository of completed projects; -Repository of project tasks; -Dataset repository; -Project team chat; -Chat for communication with project managers
Project Team Member (Actor A3)	obtaining up-to-date information about proposed projects	-Showcase of open tasks for performers; -Repository of completed projects; -Repository of project tasks; -Repository of datasets; -Project team chat;
Project Activity Administrator (Actor A4)	-remote communication with the project team; -real-time project information	-Chat center; -Project team chat; -Web-based response form for performers; -Web-based response form for project managers; -Repository of completed projects; -Repository of project tasks -Project support web services; -Repository of completed projects; -Repository of project tasks; -Dataset repository: -Working chat for communication with project supervisors

The platform supports the systematic absorption of student knowledge. Successful absorption is quantified by increased student agency. This is demonstrated by:

- a willingness to independently present the results of their work to the Project Custome and receive an objective and honest assessment;
- readiness to take responsibility for adopted project decisions within the framework of a personal role in the project;
- an improvement in the quality of final theses.

V. CONCLUSION

The following results were obtained during the study:

1. The influence of student agency on knowledge absorption was examined, which allowed us to determine the role structure of project-based learning actors in the knowledge absorption process;

2. The role structure of project-based learning actors in the knowledge absorption process was determined, which made it possible to formulate the concept of a project-based learning platform for students;

3. The concept of a project-based learning platform for students was developed, necessary for organizing systemic contextual learning and practice-oriented training for students in the region.

The authors found that

- the student's agency is manifested in their constructive behavior during knowledge acquisition. The use of project-based learning helps develop students' ability to absorb knowledge;
- the proposed role structure of project-based learning actors helps activate the process of knowledge acquisition and the degree of its assimilation. This ensures a higher level of absorption capacity;
- the implementation of the project-based learning educational platform supports all phases of the cyclical process of knowledge absorption and helps improve the effectiveness of the university's educational activities.

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