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SUSTAINABILITY ISSUES IN THE MILITARY: APPLICATION OF COMPUTER-SUPPORTED COLLABORATIVE LEARNING

Rasa Smaliukienė[1], Svajonė Bekešienė[2], Marzena Piotrowska-Trybull[3]

[1]The General Jonas Žemaitis Military Academy of Lithuania,
Šilo Str. 5A, LT-10322, Vilnius, Lithuania
[2]National Defense University, Al. gen. A. Chruściela 103, 00-910 Warszawa, Poland
E-mail: [1]rasa.smaliukiene@mil.lt; [2]svajone.bekesiene@mil.lt; [3]m.trybull@aon.edu.pl

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Abstract. The purpose of this paper is to investigate how learning in collaboration can support the development of sustainability competence in the military. The concept of sustainability in the military is controversial; nevertheless, requirements for more conscious decisions regarding economics, environment and society issues enter military practice and require rethinking the processes of military education and development. The application of computer-supported collaborative learning brings new opportunities in overcoming controversy of sustainability in the military and at the same time puts forward the solutions and skills for implementations of sustainability in the military.
Instead of using traditional approach towards sustainability as an interaction of the following three components: economic viability, social welfare and environmental protection, we described sustainability in the military as a composition of mission, management of installations and stakeholders, operations and maintenance, environment protection and quality of life. According to these categories, e-learning platform was developed. The core of this platform is the formal learning curriculum, which serves as a shell under which a variety of practices can be introduced to address the desired training objectives. The complex solution was accomplished with computer-facilitated collaborative learning that enables teem-working, collaboration and peer-assessment. Computer-facilitated collaborative learning supports social interaction in the learning system and sustains group-work within a variety of decision-making frameworks. Those features of the learning system are very important considering the controversy and complexity of sustainability in the military.

Keywords: Sustainable Development, Military, Computer-supported Collaborative Learning.

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JEL Classifications: A2, C02, C10, C61, C83.

1. Introduction

The military foresees greater dependence of training and education on web-based approaches in the future and will involve more collaborative activities between participants in the learning processes. In addition, there is a need to replace traditional instruction-centred approach with more active instruction and to develop higher-ordered cognitive skills within the military (Bonk and Wisher, 2000). Such highly sought skills include knowledge synthesis, decision-making, and collaborative problem solving (Orvis et al., 2002). As it is confirmed by previous studies (see Roberts, 2005; K.L. Orvis, A.L.R. Lassiter, 2007), collaboration in the learning process provides additional cognitive benefit, especially on interdisciplinary subjects, when participants can share their own knowledge and experience. A major benefit in collaborative learning is the exposition of alternative perspective and possibility for participants to question one's own perspective, which in turn offers an opportunity for cognitive restructuring (Ai et al., 2010). In order to achieve this advantage, a major emphasis of work on

collaborative learning is placed on drawing out aspects of an issue where disagreement among the participants is found so that they will address the disagreements explicitly and benefit from the collaborative learning process.

Collaborative learning brings its biggest value when new challenging topics in education emerge. In our cases, we chose the topic of sustainability in the military. The topic comes from the pressure of social and political environment to implement economically, environmentally and socially conscious decisions in the military. It brings the demand for sustainability competence which includes knowledge from different study subjects that need to be integrated in the education process. Additionally, education process requires involving different practical cases and participants' active interactions in sharing their experiences on the topic.

Computer-supported collaborative learning focuses on the social dimension of learning processes; it also involves technology as a tool for collaborative decision making. This paradigm overcomes the most challenging question in the adult education, as current educational practice is mainly based on the youth education and is not designed according to the adults' needs and capabilities to share their knowledge and experience. Meanwhile one of the most important elements in the adults' development is an opportunity to provide their feedback and suggestions to other participants. In this view, knowledge-sharing by collaboration and peer-assessment are two main features in the institutional competence development.

In this paper, we discuss how the processes of information sharing, disagreements and discussions are initiated and managed and how they are connected to formal learning process by developing students' competence in sustainability. We apply computer-supported collaborative learning that facilitates social interaction in the intelligent collaborative learning system.

The article is organized as follows: in the next section we discuss the controversy of sustainability in the military and the possibilities for its development using learning approach; in Section 3 we described a learning platform by drawing a conceptual framework towards the development of competence in sustainability; in Sections 4 and 5 we provided technical solutions for the implementation of collaborative learning system: we proposed our own architecture of the e-learning system and algorithm design. The article concludes with summing-up of the results of our case and presentation of some thoughts about possible directions for its development in the future.

2. Problem Statement: Controversy of Sustainability in the Military

The concept of sustainability in the military is controversial; nevertheless, requirements for more conscious decisions regarding economics, environment and society issues enter military practice and require rethinking the processes of military education and development. The application of computer-supported collaborative learning for the development of sustainability in the military organizations brings not only new opportunities but also some new challenges. Firstly, the concept of sustainability in business and public institutions has been developed as an idea of absolute positivism; meanwhile the development of sustainability in the military is restricted because of the specific functions performed under extreme situations and the pressure of time (Mohamed, 2009, Kober, 2011). As the leadership in the military is associated with high flexibility versus control and high compatibility of organizational changes versus stability of the system, the objectives of the sustainability in the military practice is changing constantly. Besides this internal dynamics, the military, as any other organization, is influenced by social, environmental and technological changes that require not only technical but also ethical decisions. The variety of questions rises related to the sustainability issues, such as quality of life of society and solders in this society, the impact of the military on human ecosystem (Shawn, 2011), environmental pollution, etc. Not only military operation but also military training is related to the sustainability issues as the consequence of technological development: new military technologies increase air pollution, noise pollution, endangered spaces and critical habitats (Lepore, 2009). All these new challenges require new institutional competencies that can be obtained in a collaborative learning process.

Sustainability in the military is challenging but not a new topic. The literature on sustainability in the military specifies two major trends. The first trend is represented by the conceptual literature or methodologies stipulating the way of integrating the principles of sustainable development into the activities of the military organization. Some concepts related to sustainability issues are already defined and discussed in the literature: sustainable peacebuiding (Gheciu & Paris, 2011), long-term sustainability of the military reconstruction activities (Dziedzic, 2009), greening of the military practice

(Durant, 2007) or the methodology of environmental analysis that integrated various levels of technology development that help to conserve fiscal and ecological resources (Saulters et al., 2010). The second trend consists of the literature presenting the results of the empirical research. The major part of this literature pursues the case analysis (learned lessons and success stories) (Readman, KS 2004 SS 2011). The researchers interpret the concept of sustainability and borders of perception of the relationship between the military organizations and its natural, social and political-economic environment and reveal the coherence of organization behaviour; however, they lack common approach towards tools for implementing such sustainability.

The practice of sustainability in the military also has its path. In respond to this social pressure, the militaries throughout the world are adopting their national environmental programs. A comprehensive case study was published in 2000: based on military practice in 29 countries, the study identifies that some environmental practice exist in all the countries as the military sector's environmental impact often outweighs most of other governmental activities (NATO, 2000, p3). The implementation of environmentally conscious decision in the military varies between the nations and depends on the societal pressure, political leadership, culture, organizational structure, legislative framework (Dawson, 2004), which becomes stricter during the past decades (Durant, 2007).

Environmental protection is only one part of the organizational sustainability. Other two parts - economic viability and social welfare – are not standardized or systematized over the military institutions. At these points institutions are facing the problems of new management referred to as the lack of competence in sustainability.

The controversy of sustainability in the military first of all comes from its characteristics. Process of sustainability (or sustainable leadership) is described by eleven characteristics: matters, lasts, spreads, is socially just, is resourceful, promotes diversity and builds capacity, is activist, is vigilant, respects the past, is patient (Hargreaves 2005). The majority of these characteristics can be expressed in terms of leading by example (Bulls, 2007) or in distributed leadership; still some of the characteristics raise questions for their applicability in the military practice. Such characteristics as social justice or diversity need to be discussed and taken from the military perspective more comprehensively. As an alternative towards these vague characteristics, AtKisson (2009) provides first attempt towards identifying the elements of sustainable leadership in the military. Figure 1 provides the interrelations between traditional approach towards sustainability and its approach towards sustainability in the military. According to AtKisson, there are six categories of activities that describe the sustainability of the military organization. These categories are: mission, management, stakeholders, operations and maintenance, environment, and quality of life (for more details see *Mission Sustainability Framework* by AtKisson, 2009). The identified categories name the fields of activity for sustainability development and certainly bring more clearness on sustainability issues in the military. Nevertheless, they provide neither solution for leaders nor direction for institutional improvement. The question regarding the depth and extent of sustainability in the military organizations is still open.

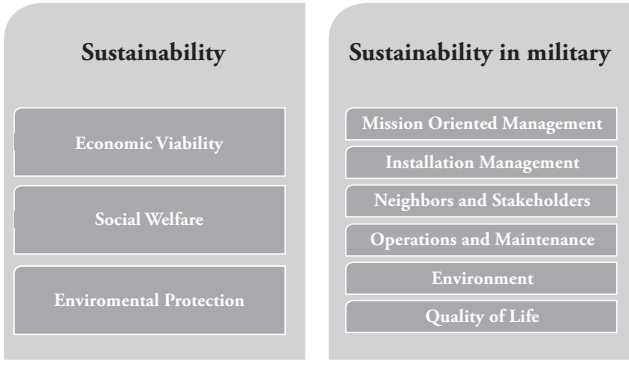

Figure 1. The Dimensions of Sustainability in Traditional and Military Way (adopted from Quaddus and Siddique 2009; AtKisson 2009).

As the efficient decision making in its various forms is recognized as a key factor in solving organizational problems (Law et al, 2011), collaborative development of competence in sustainable decision making can bring an organization new potential in finding new solutions for complex problems. Furthermore, the characteristic of sustainability in decisions adds a systemic approach towards this topic and identifies the capacity "to engage in the complexities of continuous improvement consistent with deep values of human purpose" (Fullan 2005, p17).

The shared competence in sustainability can be seen as one of the solutions towards these challenges. According to A. Hargreaves (he was among the first who introduced the concept of sustainable leadership),

sustainable development is a process and a system not a set of personal, trainable and generic competencies and capabilities that are possessed by individuals (Hargreaves, 2005). Sustainability is perceived as an institutional competence; therefore, its development is not individualized, on the contrary, the approach of collaborative learning needs to be applied. In the next section, we describe briefly the learning platform for competence development in sustainability.

3. Description of the Learning Platform

The development of competence in sustainability is a challenging process as the decisions for sustainability depends highly on the context. There are also no ready-to-use solutions as there is no solid approach towards sustainability in the military. The learning process itself generates ideas on ways and methods how sustainability in the military can be implemented. In this view, our proposed learning platform connects two types of knowledge. One type is theoretical knowledge on sustainability related fields, such as the management of installations and stakeholders operations and maintenance, environmental protection, human recourse and quality of life management. Another type of knowledge is practice-based and it is created during the process of learning.

Theoretical knowledge on sustainability was transformed into study curriculum. Accordingly, we created the platform for e-learning – the set of tasks, e-courses, platforms for teamwork and interactive peer-assessment. The effectiveness of this e-curriculum depends on the integration of practices and tools into the learning process. In our case, the development of competence in sustainability is not only about delivering a programme or administering feedback and making people go through developmental experience. Additionally, the development of sustainability competence is some type of *ad hoc* that is based on situation and cannot be generalized. According to Hoon et al. (2005), one method of making development more systematic is to design and implement an array of developmental experiences that are meaningfully integrated into each other. As it was stated in the introduction, many researchers have advocated the need for a holistic approach to the process of education and training. In our case, participants' involvement in the knowledge creation process is a crucial element of the learning process. Four-interacting elements evolve at the initiative stage of our curriculum for the interaction in developing the competence of sustainability (see Figure. 2). Student-centric approach puts *self-learner* into the centre of this framework. The efficiency of collaborative leaning depends highly on participant's motivation, attitudes and expectations; it also lies on participant's previous experience and knowledge. A participant is environed with four types of platforms. The first platform is designed for e-learning courses that participant needs to go through to get new knowledge. The second platform is intended for teamwork. After the participants get new knowledge, they can join groups for teamwork. The third platform is designed for a participant's assessment: the assessment comes from three sources: knowledge assessment - instructor-provided and peer-provided assessment. It brings the participants comprehensive perception of their knowledge and skills and inspires for future development. The last platform is designed for educational facilitation through the whole process of education starting with task delivery, consulting and guiding, and finishing with the participation in the assessment processes.

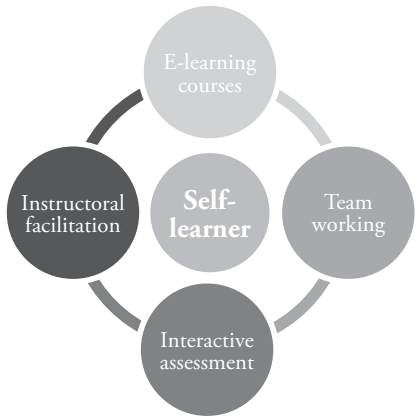

Figure 2. A concept of learning platform

These platforms represent four-stage process that was designed for intelligent computer-supported learning application. The first stage is the preparation stage. It consists of tests and self-study preparation for participation in collaborative learning. The tests allow us to measure participants' competencies in sustainability and to group the participants according to their capabilities. The stage is performed in self-learning and assessment space. After groups are composed, the first stage of the process is finished.

The second stage consists of task selection and task performance. The task for the group is selected according to the group competence level. The group performs the task using step-by-step approach. Simultaneously, the group members discuss and learn in communication and self-learning spaces. When

the task is performed, the system switches to assessment space. The third stage – communication – comes in parallel with the second stage. The group members communicate (discuss, split into smaller groups, share the information, etc.) and at the same time perform the task (on task space). From the technical standpoint, this stage is the most challenging. It is described in detail in the next section. The last stage consists of self and peer evaluation.

4. The Architecture of the Learning System

The architecture of sustainability competence development system (SCDS) is represented in Figure3**.** This architecture allows us: (1) to systematically integrate all existing information that is already collected during the last years; (2) to add new information by four groups of system stakeholders: system administrator, system developers, system experts and consumers; (3) to create internet delivery infrastructure.

The application of the SCDS can be interpreted as a flow of subsequent reclaim of the experience that leads the individual to the level of knowledge and competency. The SCDS helps in solving such challenging question as how to integrate participants' theoretical knowledge and practical experience into the learning process. Contemporary information technologies provide us with new possibilities (Figure 3):

1. To get in touch with the system server in the remote mode;
2. The databases constantly are up-to-date with new and relevant information;
3. To access the databases and receive expertise support for a decision at any time;
4. To have a multi-user connection at the same time.

The possibilities ensure the simplicity of providing individualized support for the participants. The system is designed to take individual recommendation how to develop participant's knowledge on sustainability issues.

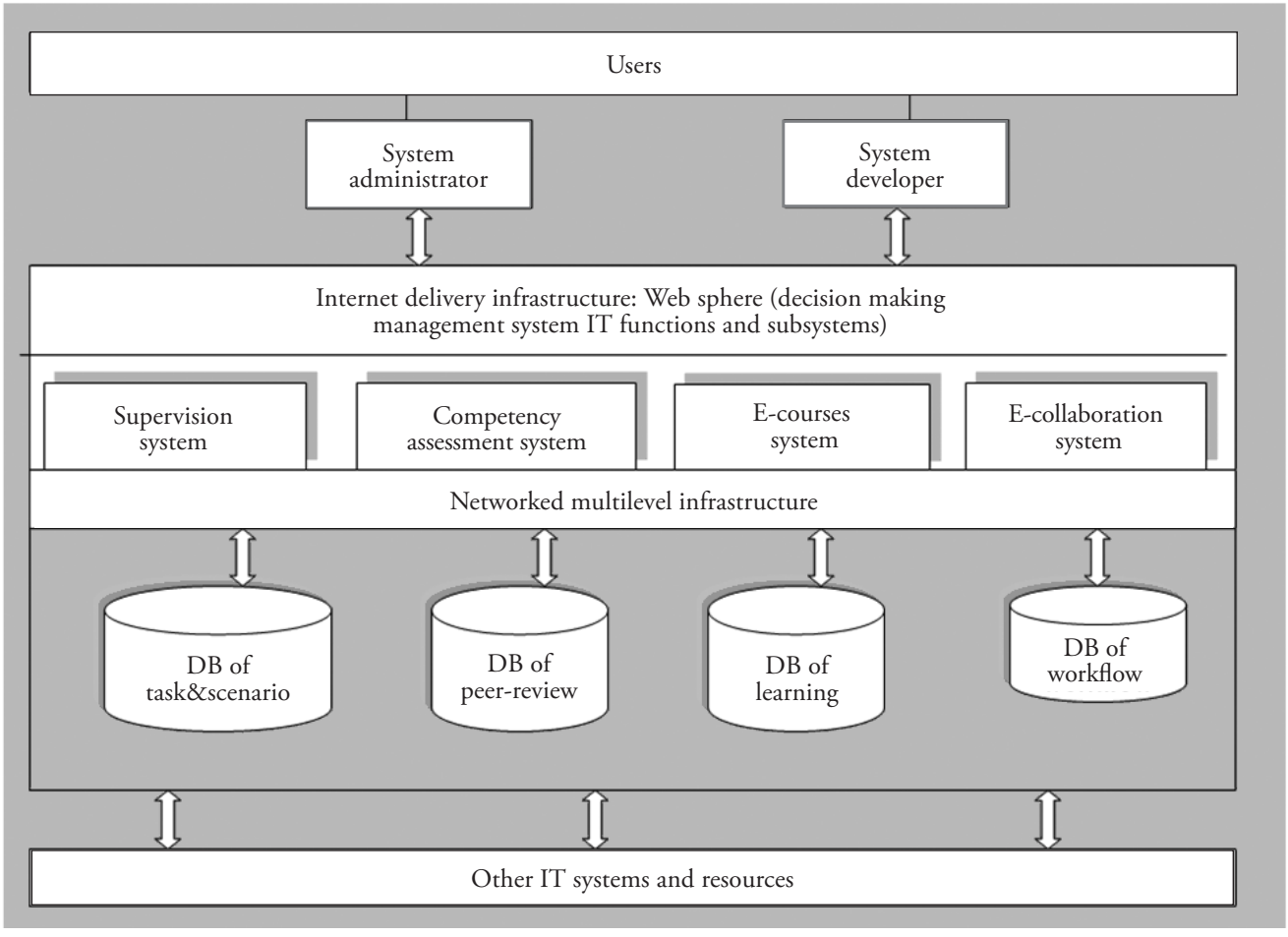

Figure 3. The Architecture of Sustainability Competence Development System (SCDS)

The SCDS in accordance with the input data (knowledge, individual experience, competence) culls necessary steps, such as multilayer tests. The SCDS proceeds when a consumer (participant) is registered and tested; he is integrated in the database of the system and all data are saved.

From a technical perspective, we suggest to place a workflow engine at the core of the internet-based decision support system (Kim 2004, Power 2002, Yao 2010). This software application manages and executes modeled computer processes and provides personalized and recommendation. The consumers are granted with an access to subsequent databases of related resources and services. At the same time, the structure of sustainability development system could be kept comparatively simple and self-controlled in the process of logic analysis. Figure 3 outlines the functions and subsystems.

The functions and subsystems reside on a networked multilevel infrastructure with strong internet connectivity and a number of databases (Jakeman & Letcher, 2003). The intranet portal systems could be used to provide different types of users with specific and customized services according to user type. The databases are designed to collect data about a number of processes and entities:

• Task and scenario database. The participant's readiness for the intended personalized integrating process needs to be evaluated; therefore, present knowledge and competencies has to be evaluated and compared to desirable knowledge and competencies. The knowledge and competencies are separated into standard competencies for sustainable organizational development.

• Peer review database contains peer assessment information, individual user profiles, privileges, and data of the user's private information. In addition, this database contains personal curriculum, testing results, and recommendations for individual development. The participants can compare their results and peer assessment. The aim of self and peer assessment is to improve competency to evaluate person's development.

• Learning database contains private environment data about user's progress history and his current competence. In addition, this database is linked with assessment and stores the metadata related to test results and instructors' assessments. These objects or "unit of tests" could be structured according to the proposed implementation concept and contain metadata (title, subtitle, creator, description, copyright, study-load), roles (system consumer, system expert), objectives of activities, prerequisites, content (steps forward, environment including knowledge object, announcement object, role of information object, etc.), method (steps towards structure and conditions). According to Hora and Helton, learning and assessment data needs to be integrated; therefore, knowledge and competencies generated through the system and testing modules are assigned to this database.

• Workflow database. Workflow systems usually use databases for the general definition of workflows (workflow templates) and databases, which contain actual instances or workflow history. The assessment tools utilized in this system is used to measure group knowledge of the collaborative processes, quality of group products and individual's impacts on collaborative learning.

As the multiplex date base system always gears up (Xiao et al., 2008), we elaborated the system environment and structure that is able to place data that is going to increase constantly. The important task is to create the administrator subsystem, which leads to simplicity and integration of administration and author's subsystems to one application.

4. Algorithm Design

The individual's development flow algorithm schema is presented in blocs (Figure 4). The algorithm starts with "start-registration" field, which is traditionally constructed for main guidelines: first, let us indicate tested person after finishing testing; second, test program is designed to present the scores for everybody, who started the registration. The first bloc is constructed for the participants' self-assessment and knowledge tests. There we have determinate learning objectives and pre-requirements for basic knowledge that needs to be shown by participants.

After preliminary evaluation, the task of the second bloc is to evaluate the tested persons and to send them into adequate group or to the bloc 3 (level 2). The results of bloc 2 influence other algorithm steps. The program user can be sent from level 1 (bloc 2) directly to level 2 (bloc 3) or to "individual phase" (bloc 4) that improves and develops participant's skills as well as grades his results.

There are many tests that can inform participant

about this performance, but according to prominent reports of the educational research, tests alone cannot provide comprehensive evaluation (see Hargreaves & Lieberman, 2010). Therefore, in this test algorithm we realized multiplex intellectual task solving schema with the direct work of user, test program and expert. This function is marked with dotted lines, which include blocs 5 to 11. The experts (bloc 11) can use discourse analysis to assess the participants' progress in collaborative process (bloc 13). The expert can use the teem-working space (block 12) to monitor the process of collaboration: initiate and support discussions, foster tolerance in consideration of other teammates' opinions, negotiation of meanings, achievement of consensus, problem-solving, and the issues of time and task management. As proficiency develops in a progressive way, the expert can modify the task and even return the participants back to the e-courses. Figure 4 represents this algorithm that realizes multiplex intellectual tasks. The second level is designed in blocs 3, 12 and 13. Group work assessment measures the quantity and quality of participants working as a team. Group work or teamwork is a core in the collaborative learning. In the simulated situations participants share tasks and decisions-making based on their previous experience and the knowledge that they got in the e-courses. Group work is measured and interpreted by the expert; the results of group work are evaluated. When the participant's evaluation is done, automated recommendations are presented (bloc 14). A participant can ask for help from the experts.

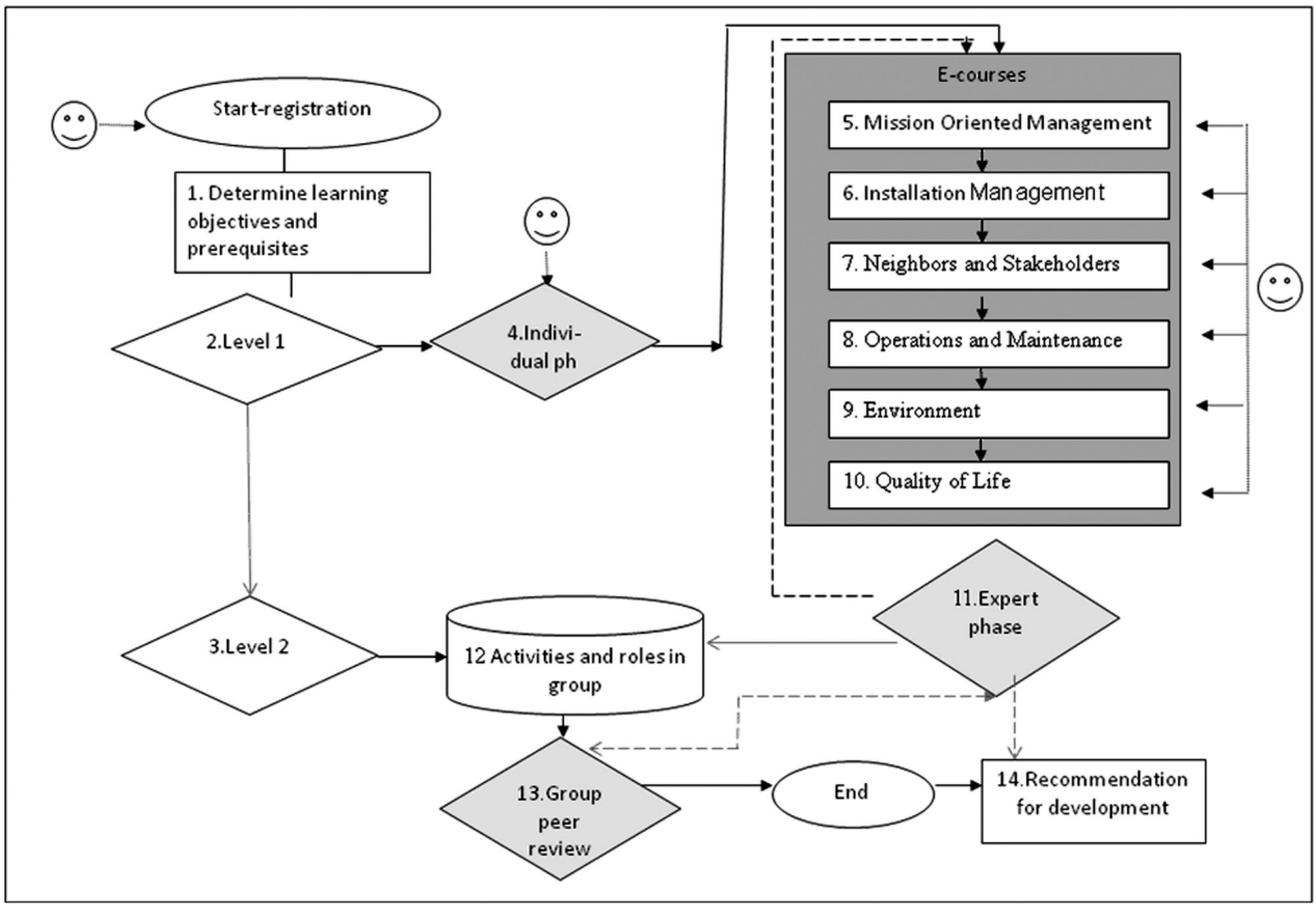

Figure 4. Assessment Flow in the Learning System

5. Conclusions

The paper described a platform for the development of sustainability competence in the military. The platform integrates diverse components, such as testing, formal learning, expertise and collaboration among the participants. Special attention was given to the peculiarities of sustainability issues in the military organizations. Instead of using traditional approach towards sustainability as an interaction of three components – economic viability, social welfare and environmental protection – we described sustainability in the military as a composition of mission, management of installations and stakeholders, operations and maintenance, environment

protection and quality of life. According to these categories, e-learning system was created. The core of the systems is the formal learning curriculum, which serves as a shell under which a variety of practices can be introduced to address the desired training objectives. The complex solution was accomplished with computer-facilitated collaborative learning that enables teamwork, collaboration and peer-assessment. Computer-facilitated collaborative learning supports social interaction in the intelligent collaborative learning system and sustains group work within a variety of decision-making frameworks. Those features are very important in justice to controversy and difficulty of sustainability in the military actions.

From a technical perspective, we suggest workflow engine placing at the core of the e-decision support system. This enables us to generate and manage personalized and adaptable individual recommendation flows in group learning processes; during the processes of individual recommendation culling, the user gains an access to subsequent databases of related resources and services. The structure of the system is kept comparatively simple and self-controlled. The functions and subsystems reside on a networked multilevel infrastructure with net connectivity and a number of databases. The databases are designed to collect and analyze data about a number of processes and entities: the task and scenario database, peer review, e-courses database, database of workflow.

The proposed system reflects the need to employ new interactive methods in the military education. The system is web-based and involves collaborative activities between participants; additionally, it replays traditional instruction-centred approach with more active instruction and develops higher-oriented cognitive skills and competencies of the participants. Today such competencies are needed in military practice because of pressure by social and political environment to adopt and implement decisions based on the priorities of sustainable development.

However, the proposed system has limitations. First, it is designed for the first time users only. Clearly there is a future need to reflect in this system the continuous growth of the participants' competence in sustainability. Therefore, important question for future development of the system is how content can be designed to motivate participants to collaborate on knowledge sharing. Second, the concept and practice of sustainability in the military is changing constantly, hence here will be a need to elaborate the processes of knowledge acquisition into the systems of diverse sources of information.

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