Towards Comprehensive Security Related Pedagogy
An Approach to Learning and Resilience

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Abstract: The indent of this study is in progress of comprehensive security related pedagogy in the forms of national-international information sharing and knowledge management with the shared policy developing, collaboration in externally funded research consortiums, structures of security and safety organisations, and integration of strategic research and development (R&D) agenda with higher education functions. The study includes multiple case study analysis of integration of R&D projects and higher education functions, revised viewpoints to comprehensive security pedagogy and R&D related learning, and an approach to adaptive change process and resilience. The main contribution of study addresses to the progress of emergent educational aspects for the security related interactions, pedagogy, integration of higher education R&D, and collective research with national and European Commission research programmes.

1 INTRODUCTION

In security related higher education, research activities and achieved high-value impacts have become globally important for regions and societies, because requirement of new competence and competent networked experts to meet current and future challenges. This progress of a result and high-value impact in higher education is a complex and global-interaction based processes, not only within technology, but merged with the economic, legislative and social environment, where they are also influenced by government policy and programmes, financial instruments, laws and regulations as well as economic boundary conditions. In this study, the focus of learners, partners, education and research system is addressed to co-creation of: 1) knowledge 2) competence 3) capability and 4) operative performance & action competence.

In this study, the term "security related learning" addresses to interactions of learners, here such as researchers, decision-policy makers, teachers and students, to explore: environmental and national critical issues; related adaptive change; and our relationship with nature, to show how innovation, design and science can benefit us to solve challenges and find appropriate ways to communicate ideas, agenda based issues and implications collectively in diverse disciplines and policy-decision systems.

In this study, the terms "adaptive and catalytic" addresses to the targets to search and find something for *new valuable purpose* and select them to as *learning scopes*; the cognitive capability to absorb them; and the common sense to arrange targets in a line that learning is addressed into appropriate action capabilities and performance e.g., interests for: security institutions; customers; policy; business; networks and organizations; and for learner's motivation and empowerment in line with purposeful bridging of studies for: 1) knowledge building 2) competence based curriculum 3) capability and resilience and 4) management of operative performance & action related proficiency.

In this study, the term "learning" is related to the increased rate of interactions and external R&D pipelines as scopes of learning and catalytic agents in a processes which shares that knowledge and higher education can be Humboldtian preserved as for a service, methodology, product, activity, capability, performance, policy, or as educational, innovative, or intellectual assets which can be exported for a high-value and impact returns.

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In the educational focus of term "action, capability and performance", students of higher education and learners are connected at the center of the collective regional-global learning as R&D process, which bearings focused profiles, stimulations for learning, regional-national learning capabilities, and related regional configuration of practice by bridging novel knowledge, competence and capability-performance co-creation in an integrative learning process.

In the continuum of this study, the term "integration" and "integrative R&D" is addressed to an interactive way of learning in where an individual learns along with a workplace, institution, school, and R&D community, such as an international research consortium and alongside a learning & R&D organization and across borders and disciplinary silos, as in a collective learning space that can be regional or individual-global oriented.

In the continuum of this study, the term *learner* refers to a student, teacher, researcher, decision-maker or participant who enriches his or her own knowledge-competence through collaborative R&D by sharing expertise and learning from others where R&D collaboration for learning is used, and *student* is used to indicate that a person is registered as a student in the database of the national Ministry of Education and Culture (Pirinen, 2015a).

One macro-level doctrine of study is that the research dimensions and methodology contains learning, and an authentic real-world research process is facilitated for collective learning in higher education institutions. Then, the objectives of *integrative learning* "can be associated through various formal and informal structures, such as R&D networks and actors, especially in developing students and learners to specialize in their areas of novel expertise where applicable knowledge is produced and mobilized in the collective R&D-related learning processes, which can be related to the externally funded R&D projects and research alongside of regional-national-global consortium's targets and the regional-national configuration and research agenda" (Pirinen, 2009; Pirinen, 2015a).

One micro-level purpose of this study is addressed to the form of higher education that focuses on the demands of the individual-national-global *comprehensive security* domain and its development, here teachers, policy and authority representatives would work more and more together "closely" in an interaction as a collective learning community that "can involve students and the implementation of study units in higher education and shared R&D, such as learning by national-international research consortiums and work packages" as realizations; e.g., in a manners of knowledge transition, catalytic and adaptive acquisition, participation and co-creation e.g., manners of R&D and learning for building something new: towards realization of research and development (Pirinen, 2013) and creating entrepreneurial universities (Clark, 2007).

The incipient concept of "knowledge economy" includes here its support for building and co-creation of knowledge by learners and organizational employees and its encouragement of individuals to transfer and utilize their knowledge and competences that are in line with the goals and strategies of organizations and the regional-national R&D agenda: the mind of used term "knowledge economy" is described early in (Schumpeter, 1939).

In this study, as grounded so far, the emerging term "resilience" is approached as manners to enhance the capability at all levels of activities to create processes that are robust yet flexible, to monitor and revise risk models, and to use resources proactively in the face of disruptions or pressures of ongoing activities such as learning, control, production, service, trade or industry.

Related resilience genealogy adresses an ability to recover from or building new position to misfortune or adaption of mandatory change. The term "resilience" includes four abilities: 1) to plan and prepare 2) absorb disturbance 3) recover from and 4) adapt to known or unknown threats. In this study, the term "resilience" follows (Holling, 1973) and (Walker and Cooper, 2011) description of genealogies of resilience.

2 LITERATURE

R&D functions on higher education institutions in Finland has expanded considerably in recent years, and established a strong role within regional-national innovation systems. The followed as searched literature has described its advances and challenges; the main challenges for the impact of R&D include the production of new knowledge, competence and innovation in R&D processes, and emergent aspects, such as the relatively new term "resilience" in environmental and operational adaptions and readiness for an institutional-regional-national configuration.

The literature data collection includes followed pedagogical aspects: the school as a center of inquiry (Schaefer, 1967); interaction between learning and development (Vygotsky, 1978); the

critical theory of adult learning (Mezirow, 1981); action learning (Revans, 1982); experiential learning (Kolb, 1984); learning by expanding as an activity-theoretical approach (Engeström, 1987); situated cognition and the culture of learning (Brown, et al., 1989); metaphors of learning (Sfard, 1998); regional configuration and path-dependency (Harmaakorpi, 2004); knowledge building theory (Scardamalia and Bereiter, 2006); learning to work creatively with knowledge (Bereiter, 2007); the new production of knowledge (Gibbons, et al., 2008); situated learning (Lave and Wenger, 2009); and learning regions in the globalising knowledge economy (Asheim, 2012).

In the macro-scale, as in active environment of this study, higher education institutions are traditionally seen as providers of new knowledge and competence (Schaefer, 1967; Scardamalia and Bereiter, 2006; Clark, 2007); Humboldtian model of higher education and high value returns are addresses in the studies for: development of services (Pirinen, 2013); technology and policy (Harmaakorpi, 2004); co-creation as manner (West, 2009); value-building (Sawyer, 2008); economic returns (Etzkowitz, et al., 1998; Nunamaker and Briggs, 2011); path-dependency (Nelson and Winter, 1982); and living-labs (Ståhlbröst, 2008).

In this study, an expected new progresses are taking place with regard to cooperation in emergent value networks, co-created innovation, the contribution of pioneering innovations, and regional development affecting social and global development: e.g., the term "co-creativity" which is understood regarding collaboration and described as the "secret to breakthrough creativity" (West, 2009); learning is placed in collaboration with innovation systems and living-labs (Ståhlbröst, 2008); a last-mile research approach for general utility production that in the end addresses the value-building and economic returns on a national-global scale (Nunamaker and Briggs, 2011); and an integrative learning space and examples of the use of the research methodology as continuum and the scale of the integrated research processes in the context of international externally funded security related research projects (Pirinen, 2013).

In this view, new types of learning interaction, trust, confidence, and collaboration are required for the stimulation of creative innovation in services, technology, the economy, and society. In the context of this study, it was anticipated that learning is steered by research and worth of new knowledge, as different forms of R&D-related learning, that are based on the demand for development of the institutions and employment market, can be used in the workplace to generate new competence, capability and sustain operational performance, which is seen as the ability to do R&D in sustainable manner: e.g., the regional capabilities to increase productivity and development in a region by using a research-oriented approach (Bereiter, 2007) and support for a learner's imagination and creativity in integrative learning transactions, especially in the sense of interactions and collaborative functions of higher education institutions and regional configuration, governance policy, within regional science-based clusters and strategy scenarios (Pirinen, 2013). As a consequence, the knowledge obtained is also focused and deeper, profiled, and path-dependent; in this way, focused universities are making a difference, as (Clark, 2007) anticipated.

Most cyclic, creative and innovative part of learning processes in higher education institutions can pedagogically be linked to the principles of knowledge building and co-creativity as: "knowledge building provides an alternative that more directly addresses the need to educate people for a world in which knowledge creation and innovation are pervasive; knowledge building may be described as the production and continual improvement of ideas of value to a community, through means that increase the likelihood that what the community accomplishes will be greater than the sum of individual contributions and part of broader cultural efforts; knowledge building, thus, goes on throughout a knowledge society and is not limited to education; and knowledge building as applied to education, however, the approach means engaging learners in the full process of knowledge creation from an early age" (Scardamalia and Bereiter, 2006, 2-3).

Communication as nexus constitutes the co-creation of something, reference (Vanderstraeten and Biesta, 2016, 160-174) addresses to the added value of pragmatism to human communication, which is not a question of information but rather of meaning. Each person must first construct *a specific meaning individually* (Vygotsky, 1978). A shared understanding in interaction becomes shared property and mind between participants, which exists in social practices and not in the thoughts of individuals (Biesta, 2004). These perspectives are in same line with the Gibbons Mode 2 concept of socially distributed knowledge (Gibbons, et al., 2008).

Description of Gibbons et al. (2008) characterise knowledge as follows: Mode 1 knowledge refers to a conventional knowledge production method in line with the "old paradigm". Knowledge is produced

and created in a researcher-oriented way within a specific discipline. This type of knowledge is mostly theoretical or experimental, hierarchical and static. The research problems are set and solved within a science community.

In turn, Gibbons Mode 2 knowledge involves participation by users and is produced in the context of application. Knowledge is created in a transdisciplinary and multidisciplinary framework. Knowledge can be characterised as heterogeneous and heterarchical, and is produced in social processes. Social accountability and responsibility, reflexivity and new forms of quality control are related to Mode 2 knowledge production.

3 METHODOLOGY

The data collection for continuum of this study is cumulative and systematically used for a qualitative analysis; followed (n) indicates as an instance of data collection used for this analysis between January 2010 and September 2016.

The data collection is comprised according to the description by Finnish Academia Result Guidance including eighteen (n=18) cumulative categories: 1) scientific publication (n=42) according to publication forum classification 2) number of open data collections (n=2) facilitated and licensed data collections (n=3) used 3) collective creation of international publication (n=6) articles 4) data of international researcher exchange 5) integration of education (n=6) study units, related (n=3) thesis and related (n=3) dissertations 6) data of externally funded (n=3) research projects in H2020 and data of new applications (n=3) for H2020 funding 7) presentations and audiences with (n=6) stakeholders 8) data of (n=4) workshops and (n=6) seminars, creation of (n=4) events for research and development 9) participation to public audiences, such as in a parliament and participation to statements 10) publication in (n=6) newspapers and general descriptions according to publication forum classification 11) invited (n=3) presentations 12) indicators of social media: Twitter, LinkedIn, Facebook and (n=3) homepages 13) support of public events for international, national and regional audiences; and data of economic indicators, such as 14) investigations 15) patents 16) licenses 17) spin-offs and 18) start-ups.

In this study, the multiple-case study approach is used; the method is relatively well known and explained well in references that address "the case research strategy in studies of information systems" (Benbasat, et al., 1987); "building theories from case study research" (Eisenhardt, 1989); "case studies and theory development in the social sciences" (George and Bennett, 2005); "qualitative data analysis" (Miles and Huberman, 1994); "real world research" (Robson, 2001); and "case study research design and methods" (Yin, 2009).

The multiple case study followed replication logic, and the selected cases serve in a manner similar to multiple experiments, with similar results: a literal replication or contrasting results in a theoretical replication predicted explicitly at the outset of the investigation (Corbin and Strauss, 2008). In this study, the case study analysis brings an understanding of a complex issue and object and can extend experience or add strength to what is already known through previous research and reviewed literature. Here, case studies "emphasize a detailed contextual analysis of a limited number of events or conditions and their relationships when the relevant behavior is not manipulated and the role of the researcher is that of an *objective outsider*," as in (Herr and Anderson, 2005) positioned.

Reference (Yin, 2009) noted that the simplest multiple-case design would involve the selection of two or more cases that are believed to be literal replications, while a more complicated multiple-case design would result from more and different types of theoretical replications, such as middle-range theories (George and Bennett, 2005). In this study, "the end of data collection and analysis was indicated by saturation, when no new information emerged for the research purpose" (Corbin and Strauss, 2008).

In this study, the data collection and analysis includes security related European Commission Horizon 2020 funded R&D projects (n=3), such as PERSEUS, ABC4EU and EU_CISE_2020 and data of tree new applications for H2020 (n=3), such as MARISA, EPIC and CEA submitted in August 2016, In addition, the data collection of this study includes the Academy of Finland Strategic Research Council call of Security in a Networked World Programmes and accepted and then funded project's data and its first analysis of project namely From Failand to Winland (#WINLandFI).

PERSEUS: "Protection of European Borders and Seas through the Intelligent Use of Surveillance is coordinated by INDRA Sistemas with n=29 partners. The timeframe of the PERSEUS research was between January 2011 and December 2014.

ABC4EU: "Automated Border Control Gates for Europe is European Union wide R&D project and involves a Consortium of 15 partners from 8

different countries. The purpose is to make border control more flexible by enhancing the workflow and harmonizing the functionalities of automated border control gates. Project started in January 2014 and will last for 42 months."

EU_CISE_2020: "European Union's Information Sharing Environment addresses to steps forward along the accomplishment of the European roadmap for Common Information Sharing and Distributed Systems and Services Environment. Timeframe of EU_CISE_2020 is between 01/06/2014 and 01/06/2017."

From Failand to Winland (#WINLandFI), the Academy of Finland Strategic Research Council funded research from April 2016 to March 2019 as ongoing case.

And new H2020 applications data followed: MARISA: Maritime Integrated Surveillance Awareness; EPIC: Emergency Response Planning Capabilities; and CEA: Cybersecurity Economics and Analysis.

4 RESEARCH FINDINGS

In the perspective of national environment, study revealed that Finland still continues to score high on the European Innovation Score Board. The national goal of today is to win up Finland to "Winland" as to be one of the most competent nations in the world, which means a huge demand for higher education and research.

The analysis exposed that, as far as R&D is concerned; Finland has gained a reputation on a European level for its innovative research activities and R&D strategies that particularly focus on the "knowledge economy" and "resilience". The security related higher education as national educational environment of study gives one respectable field for higher education to operate actively and collaboratively with field's stakeholders in the region-national even global level and interactions.

An emphasis on regional-national development and R&D is a significant purpose for all higher education institutions in Finland. In the past few years, the structural reform of higher education in Finland is represented, this reform has been widely and actively discussed nationally in order to develop the national and regional innovation system and clarify the shared nature of the higher education system. This produces new, collaborative knowledge and competence and searches for creative solutions for focused problems and challenges at various levels. The importance of R&D is clearly emphasised when combining regional competence, participating in networks and utilising different partnerships in shared R&D processes. The functions of R&D at all higher education institutions can be reasoned by a purposeful and experiential approach, as producing expertise in processes of knowledge transfers, transformations and catalytic-resilience related learning aspects.

In the perspective of higher education in the security management, a regional-national capacity to provide security related knowledge-competence-capability paths and knowledge interconnections depends on ability to continuously innovate to ensure technological leadership and be a credible partner in networks. Then, as examples of necessity of resilience, current and emergent challenges can be remarked such as the recent dramatic falls in investment in R&D and risk management undermining efforts to support the security and sector, broader defence and security goals.

The central *challenges* faced by the realization of the shared R&D functions in higher education consisted of the following: 1) the establishment of a new management forms and culture and control of the mass of projects through the R&D realizations and by higher education institutions, with trust and confidence 2) the balancing and modularizing of cognitive load and the challenges of learning in R&D realizations 3) pedagogical development and continuous, relatively adaptive change in R&D that pose great challenges for teachers 4) understanding of the meaning of student-centered R&D in communities of work and workplaces as research for work 5) ethical issues 6) the development of incipient internationalization and individual-global interactions 7) the measurement of the effects and development of utility, usability, and strategic measurement as an evaluation design structure in higher education and 8) dissemination of the new R&D-related learning model and ethic in the context of security related higher education.

However, the continuum of data have revealed that R&D related learning can be seen as one *proficient mechanism* of knowledge transfers in higher education institutions and can advance such as: 1) development of R&D capabilities 2) joining the agenda-based R&D activities for collective education 3) fitting together the strategies of domain, emergent R&D profiles, and education processes 4) improvement of knowledge reserves and resilience 5) raising the students' aspiration and participation in R&D so that they are the activating forces in the collaborative R&D 6) teachers in

continuous interaction with the environment, which allows for quick reactions to changing, agile and dynamic needs and 7) a guide of teachers' R&D-related activities and collective thinking.

From the viewpoint of regional-national development and research in higher education, the research data implicates that new knowledge can be co-created in the context of the security related employment sector as well as at institutes of authorities and higher education, and that learners and students should be placed at the heart of R&D activities. Improvement of R&D activities in higher education institutions should specifically promote economic, social and cultural development in the regional and national spheres. For example, the investigated data included recommendations by focus groups addressed directly to the Gibbons Mode 2 knowledge production; user-orientation and genuine problem-solution based solving.

Study discovered that creativity related knowledge production emphasises the importance of broad reflection, scrutiny and continuous negotiation, e.g., the importance of nexus. The study revealed also that new knowledge production demands active participation by various actors and the social sharing of knowledge. This finding can be closely linked with discovery process, which brings about new perceptions, knowledge, innovation, competence and capability. A precise distinction between science and technology R&D becomes increasingly more difficult. This is evident in the creation of innovation; the competitiveness of the innovation system is challenged by vary knowledge models for both cooperation and competition between producers of new knowledge, competence and capabilities.

In the investigated security projects (n=6), one advice for future is that creativity and innovative learning scopes should be more systematically designed and adopted for research, development and innovation activities in the context of current knowledge, competence, capability and performance (action competence) settings. Hence, the creativity and innovation approach steers R&D process planning towards increasingly participatory, dynamic and creative forums of new competence production and, it will enhance learning.

Then, one revised view to (Pirinen, 2015a), this study addressed to the improved understanding and mind of the term "scope" or *learning scope* which can be useful for resilience as for *elastic* nature and for focusing on viewpoints, learning paths, and creativity, especially in perspective of students integration to R&D. The consortium based integrative learning spaces involved followed: 1) the term "scope" was useful to a satisfaction, atmosphere, mutual trust, confidence and "learning to like or dislike" in a learning space where a student takes "a scope" and makes his own *individual meaning*, creation, improvements, and validation into the selected or shared learning target as "shared scope", e.g., as in a new application building process, which resulted from scope-based thinking 2) a "scope" was not loaded by a teacher's knowledge in the beginning of studies, so scope-related knowledge can be composed openly by a student's viewpoints, interests, aspiration, and motivation, not only teacher's or problem-based viewpoints 3) here, the term "learning scope" refers to a mental or resilient physical target or subject matter that something deals with in learning 4) the aim of using the "elastic scopes" in the beginning of R&D related learning process as frame to support a student's imagination and creativity in learning, and the assumption was that the understanding of resilience and additivity, the *elastic scope* would generate and maintain the motivation and meaning-spirit for learning, balancing the judgments and potentials of objectives, goals, and targets; e.g., the tuning of a cognitive load in a lifetime of studies would be balanced by students and teachers by "scopes" 5) the "scope" addresses the idea that, between two people, there is third dimension as a "scope", e.g., a model, artifact, tool, concept, or mental or social factor with which students may share, transfer, adapt and build knowledge; it communicates, activates, empowers, emancipates, and motivates their personal or team learning spirit and confidence; and 6) "the "scope" increases resilience, "everything does not go as designed" and elasticity in solution based learning, both views can be approached in the reactive and proactive sense.

One additional finding of study is that creativity and innovation related knowledge is produced in kind of *knowledge-creating communities*, such as research consortium and teaching community in universities and within teacher teams with participators from the working life. Teacher teams are characterised here as a supportive working culture which are open to dialogue, someway similar that an enriching community, clearly it is significant for creativity and dignity. Study revealed that partnership is based on mutual respect and trust, which is clearly as the base prerequisite for communities that work creatively in order to achieve shared demanding goals, such as targets of work packages in research projects. In this sense, an "enriching research consortium", e.g., H2020 can

rise up to innovation and creativity, which can increase in an atmosphere and spirit of freedom. Researchers and innovators should have the freedom to work creatively towards the vision, but, on the other hand, this freedom would be achieved through responsibility, activity, mutual trust, confidence and deliverables as results. Social and cultural realities and cultural path-dependency have an impact on the communal creation of knowledge, and cooperation and interaction expertise are, therefore, highly imperative in the learning process. It can even be comprised that the individuals alone cannot by themselves even attain close to the deliverables and results as *samples of evidence* which are achieved by a network-based community that works and learn collaboratively, and which establishes a common interest, objective, dignity and commitments.

As final remarks: the comprehensive security related integrative R&D has a great high-value impact on the pedagogic way of teaching which is delivered in students' knowledge, competence and capability building processes. The crucial factors are not only subject-specific competence but also a research-oriented, developmental approach, interaction skills, the ability to encounter colleagues, students and partners dialogically, and having the pedagogical and leadership competence. The qualities of an expert promote the implementation of good, high-quality teaching and fostering the students' motivation, participation and dignity. The emphasis is on motivation, spirit, dignity, guidance, learning process, and mutual reflection.

5 DISCUSSION

The comprehensive security related education and new pedagogical solutions have possibilities to further current R&D activities in a way that brings creativity and innovation building related knowledge towards of competence-capability and sustain performance, action resilience and competence. The academia-consortium retains and external funding structures of research activities already exist, as investigated here, however, the comprehensive security integration need more action competence and capability related future studies.

There are many reasons for future progress and discussion of the term "resilience", such reasoning as: the number of systems, interconnections and transaction elements increases over time; the system complexity increases and the resulting interactions becomes challenging to maintain, e.g., number of updates, difficulties in using and facilitation, life cycles, continuity management and for understanding emergent relations between the terms "resilience", "elastic", "robustness", "complexity" and "persistence". In this discussion, the term "resilience" would be first related to the term "robustness". In this setting, as first encompassing that, the term "robustness" addresses to "the degree to which a system is able to withstand an unexpected internal or external event or change without degradation of in system's performance." Then, the term "robustness" indicates "the degree to which system operates correctly in the presence of exceptional conditions." On the other hand, the "resilience" refers to the system's ability to recover, retrieve, restore or regenerate its performance after unexpected impact that declined its performance, as (Kott and Abdelzaher, 2014) proposes.

In this context, as understood so far, the significance of the term "resilience" addresses to the ability of a system, community or society exposed to security related threats to resist, absorb, accommodate to and recover from the effects of a threat in a timely and efficient manner, including through the preservation, restoration and adaption of its essential basic structures and functions to state that it is possible to going on and continuity. Regardless that the term "resilience" includes strong relations to reactive nature in the cases of study, such reactive terms as respond, recover, retrieve, restore and adapt, our furthered viewpoint is that there are many proactive dimensions, such as prepare, prevent, configure and protect as well.

Currently, in the #WINLandFI and EPIC application, there are ongoing discussions of followed: resilience and stability of ecological systems (Holling, 1973); community and mechanism of critical and resilient digital services (Pirinen, 2015b); resilience in globalization and transitional pathways (Wilson, 2012); genealogies of resilience (Walker and Cooper, 2011): from systems ecology to the political economy of crisis adaptation and management (Brassett and Vaughan-Williams, 2015); resilient systems (Suri and Cabri, 2014); and resilience engineering (Atooh-Okine, 2016).

The future discussion of knowledge economy in higher education institutions can be addressed the use of knowledge-intensive technologies and services, such as knowledge co-creation and knowledge management, to produce information-intensive economic benefits and new workplace creation integrated into R&D-related themes and integrative learning. The comprehensive security related education shows possibilities to further current R&D activities. It means more creativity and

innovation building related knowledge towards of competence-capability and sustainability.

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