DESIGNING ENVIRONMENT FOR RESEARCH AND LEARNING IN SECONDARY SCHOOL

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Abstract

Contemporary pedagogy searches for the ways to reorient teachers’ and students’ activity towards the aim of sustainable development. The teacher becomes involved both in teaching/learning activities and in researching the environment of his own activities in order to design the environment favourable for students’ development. The article presents the analysis of research and learning environment and activities that promote the development of students’ research skills in one of Latvia’s secondary schools. It displays the research methods and means identified in students’ research works, and evaluates the research environment in the school. Several types of environment were identified, which teachers can purposefully use to develop the research skills of their students. The results of analysis can be implemented by educational institutions, which organise students’ research activities. The described methods and means can be used in learning environment with no supplementary material resources required and involving teachers in research of school environment therefore re-orientating their professional frames of reference to address sustainable development.

Key words: learning environment; research environment; secondary school; students; teachers; research work.

National Standards of primary and secondary education in Latvia orientate the content of education and instruction towards the development of students’ research skills (Regulations of the Cabinet of Ministers, 2006, 2007). In conformity with the National Standards, each educational institution devises its own practical solutions how to develop students’ learning and research skills. Educational institutions differ in terms of quality and scope of these activities as well as in public image and school environment.

Study of students’ research works in one of Latvia’s secondary schools revealed that students chose various research approaches and means. Specific types of environment were sought as to orient the students’ research activity towards sustainability and evaluation was made of the link between subjective/objective and individual/collective contexts in students’ research works. The study tries to identify frames of reference applicable for the analysis of school environment and organisation of secondary school students’ research activity, linking theoretical ideas with relevant practical activities.
Grounding the research

Several broader and narrower theoretical perspectives were integrated as to provide the theoretical background for the study. The broader view of this study was the perspective of sustainability as the aim for education. The role of the learning in re-orientation of education towards the aim of sustainable development is widely described in pedagogical literature and has been substantiated from various perspectives (Ballard, 2005; Ferreira, Rayan & Tilbury, 2007; Hytonen, 2007; Lakatos, 2007; Pipere, 2006, 2007).

A more detailed view on the structure of learning reveals the significance of learning environment and its influence on learning and development of learning skills. Learning begins with a question and trying to find an answer on it (Gibboney & Webb, 1998). Thus, the essence of learning environment can be inferred from the very nature of learning — emergence of the question and interest that transforms into inquiry and research activity that provides an answer to the question. Therefore, the research activity and environment that favour the development of research skills constitute the most significant aspects of learning and simultaneously determine the environment favourable for learning.

Learning and research embedded in it is a process that provokes changes. The changes most needed today are orientation towards the sustainable development. In the 21st century, the critical directions in education is sustainability (Hildebrand, 2008), search for sustainability-related contexts (Ballard, 2005), evaluation of the subjective and objective in research and learning activity (Ballard, 2005; Bednall, 2006; Wilber, 2000), identification of the dimensions of sustainability (Hawkes, 2001; Bott, 2004; Salite, Ignatjeva & Salitis, 2007), use of specific potential of action research (Bednall, 2006; Pipere & Salite, 2006; Salite, 2006; Salite & Pipere, 2006), study of the issues of researcher’s identity (Pipere, 2007a, 2007b, 2007c, 2008).

The study heavily draws on the works of Dewey complemented with the nuances of the 21st century (Hansen, 2002; Hildebrand, 2008). Phenomenological suggestions for action research and use of the subjective factor in research (Bednall, 2006; Creswell, 1994, 1998; Hostetler, Macintyre Latta & Sarroub, 2007) as well as the idea of teacher’s personal experience theory (Levin & He, 2008) are also relevant to reach the proposed aims.

Dewey argues that educational environment at school should be simplified, purified, balanced and steadying: (1) A “simplified” environment implies respect for students’ present capacities and powers with an eye on extending them; (2) A “purified” environment draws out students’ open-mindedness and willingness to listen to others; (3) A “balanced” educational environment can balance students’ individual interests as well as their family-centred and community-centred outlooks; (4) A “steadying” educational environment should help students to “coordinate” their understandings and dispositions and assist them in seeing their lives as a whole (Dewey, 1997: 20-22).

Dewey believes that teacher-created environment can foster not only student’s learning but also development of teacher as a human being. Dewey concludes that teachers cannot make themselves more knowledgeable, careful and skilful outside the environment. They develop these characteristics through interaction with the environment, students, educational content and any other books, materials, ideas and colleagues or other people.

According to Dewey, the supreme aim of learning is students’ engagement, involvement and engrossment. Research environment is an effective means to ensure
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teachers’ and students’ practical activity towards reaching this aim. A good teacher “gives the students something to do, not something to learn; and the doing is of such a nature as to demand thinking, or the intentional noting of connections; learning naturally results” (Dewey, 1997: 154).

Nowadays, Ballard (2005) supplements Dewey’s suggestion with a simplified model focused on three conditions that promote direction towards the aim of sustainable development: (1) awareness of what is happening and of what is required, (2) agency or the ability to find a response that seems personally meaningful and (3) association with other people in groups and networks. In direction towards sustainable development, all three conditions cannot be isolated; they should complement each other in order to achieve the core process of this direction – “action and reflection”. In the presented study this model was used to define the conditions of research environment that direct changes towards the aim of sustainable development.

Furthermore, Ballard has grounded his model in Wilber’s (2000) idea about contextual barriers that hamper change. Ballard has analysed Wilber’s contextual barriers or factors (individual-subjective or values, worldview, etc.; individual-objective or the socially demographic, knowledge, etc.; collective-subjective or culture, common norms, etc.; collective-objective or the political, economic, technological, etc.) in the context of learning processes that promote changes towards sustainable development (Ballard, 2005).

For this study, the views of Ballard and Wilber were synthesised on the grounds of subjectivity/objectivity, which is particularly significant in research. Among the approaches used in research works and within the content of sustainability displayed by secondary school students, the individual/collective and the subjective/objective were identified in different proportions.

The performed procedures of qualitative analysis were based on phenomenological methodology (Bednall, 2006; Creswell, 1994, 1998; Hostetler, Macintyre Latta & Sarroub, 2007) that unites subjectivity and objectivity in a “truly” creative process. The truth is generated by epistemology, which is grounded in the subjective. In research works written by students, knowledge and the truth are also grounded in subjective experience. In the field of this experience, begins a dance between the connoisseur and the known and among the meaning, interpretation and truth (Ladkin, 2005). Torbert (2001) has called this phenomenon “the first-person dimension of inquiry”.

Teachers’ individual frames of reference begin with this first-person dimension, which eventually transforms into teachers’ personal experience theory. The researchers have explored teachers’ “practical knowledge”, “practical theories”, “relationships between teachers’ beliefs and actions”, “personal practical knowledge”, “personal practical theories” (PPTs) and so on (see Levin & He, 2008). In all these interpretations teachers’ beliefs become an important focus of educational inquiry acting as a filter through which teacher acquire and interpret new knowledge.

In this study the concept of PPTs can explicate the broader frame of reference that teachers create and develop in order to comprehend their relation to learning and research environment and their own idea of inquiry. With these PPTs in mind teachers design the learning and research environment favourable for development of research skills in secondary school. This phenomenon is also called the second-person inquiry in the action research (Torbert, 2001) and it exists as a cooperative inquiry into themes of shared interests, and in cooperative activities. Second-person inquiry provides support
for the first-person inquirer’s capacity for critical abilities to live in the inquiry, reflect in action, conceptualise new learning and stay open to changes. Therefore the second-person inquiry fosters the development of the first-person inquiry. These two kinds of inquiry are complementary connected. Given study respects this connectedness, but in the qualitative analysis of learning and research environment in secondary school the focus are on already existing contexts of school environment. In this framework learning and research environments are not separated but viewed as complementary connected processes.

Therefore, the aim of study was to identify learning and research environment in secondary school. The inquiry was based on the central question: What types of learning and research environment are favourable for research work conducted by students in secondary school and what criteria can be highlighted in each type of learning and research environment?

Research approach and sample

The presented study is outcome of two-step qualitative research strategy. The current research is grounded on the results from the previous studies by author (Grishane, 2007a; 2007b; 2007c). These results obtained earlier through the phenomenological or concrete experience analysis (content or/and narrative analysis) of students’ research works (N=1392) revealed the research approaches used in these works. Current study tries to determine 1) the types of learning and research environment used for research work in secondary school and 2) specific criteria of learning and research environment fitting to the students’ research means and needs.

The sample providing the main research data consisted of 1392 students who have written and successfully defended their research works in one of the secondary schools of Latvia from 1999 to 2007. Majority of works received a high evaluation: 20.2% of works were evaluated as good (i.e., received a grade 7) and 57.7% were evaluated as very good, excellent or outstanding (i.e., received grades 8-10).

The types of learning and research environment were distinguished analysing the teachers’ personal and professional experience and conditions created in school for organization of research work. The types were identified discerning their most typical features and summarizing them under the matching title. The features were elicited from the critical reflection on author’s and her colleagues experience in organization of students’ research work from 1999 to 2007. The results of this research in this article will be presented in descriptive form of qualitative analysis.

Approaches in students’ research works

Students’ research works (N=1392) were analysed qualitatively in order to identify most typical research approaches (Grishane, 2007b). It was concluded that approaches can be evaluated as (1) quantitative or qualitative, (2) phenomenological research or description of concrete experience. The variety of approaches used the combinations of these two basic strategies. Four typical research approaches were identified (see Table 1).
Table 1. Research approaches in students’ research works (N=1392) from 1999 to 2007
(Grishane, 2007b)

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage of works</th>
<th>Research approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>37.8</td>
<td>Qualitative phenomenological research</td>
</tr>
<tr>
<td>B</td>
<td>29.5</td>
<td>Qualitative research of concrete experience</td>
</tr>
<tr>
<td>C</td>
<td>16.7</td>
<td>Quantitative research of concrete experience</td>
</tr>
<tr>
<td>D</td>
<td>15.9</td>
<td>Quantitative phenomenological research</td>
</tr>
</tbody>
</table>

**Means of research within students’ research approaches**

Qualitative analysis provided the possibility to reveal also the most typical research means used by students. Research means were conceived as the subcategories of research approaches. The discovered research means allowed to evaluate (1) students’ needs for matching learning and research environment and (2) the correspondence of school environment, created by teachers, to explicated students’ research means.

**Qualitative research: Eliciting types of environment**

The specific learning and research environments were distinguished using the following strategy:

(1) general aspects of school’s environment were selected on the grounds of above mentioned theoretical analysis: (a) organization of activity, (b) learning activity, (c) intellectual activity, (d) informative environment of learning, (e) internal and external environment of education, (f) context of thinking activities, (g) principles of subjective world view;

(2) three criteria (sub-categories of general aspects) for every specific learning and research environment were discerned from the professional experience: (a) formal/non-formal/informal education (environment for organization of activity); (b) teaching/learning/practical activity (environment for learning activity); (c) knowledge/skills/attitudes (environment for intellectual activity); (d) information/narration/discussion (informative environment of learning); (e) external conditions of organization/inner conditions of organization/individual’s life environment (internal and external environment of education); (f) global influence/local influence/individual choice (environment of contexts for thinking activities); (g) ecology/integration/spirituality (environment of principles of subjective world view).

(3) each type of specific environment was evaluated in the context of students research approaches and means clarifying the possibilities to implement these approaches and means in learning and research environment designed by teachers’ cooperative activities.

**Results**

In order to demonstrate the possibilities of school environment to foster the students’ research work, the specific types of learning and research environments will be analysed further. The research approaches and means of secondary school students will be
displayed in Tables 2-8 that will be complemented with the descriptions of corresponding learning and research environments.

(a) Formal/Non-formal/Informal education

Analysing approaches and means of students’ research works, it was found that experience obtained by students in formal, non-formal and informal education was applied. All secondary school students are involved in the formal learning process. The non-formal activities proposed in the school likewise involve all students; statistics show that on the average, each student takes part in several non-formal types of activity (hobby groups, special courses, projects).

Evaluation of students’ engagement in the activities of formal, non-formal and informal education reveals that the activities proposed in the school promote development of research skills through the means of activity reflected in Table 2.

Table 2. Research approaches and means in environment determined by Formal/Non-formal/Informal education

<table>
<thead>
<tr>
<th>Research approach</th>
<th>Means of learning and research</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Extension of the existing theory, interpretation. Descriptive narrative.</td>
</tr>
<tr>
<td>B</td>
<td>Extension of the existing theory, interpretation. Experience of a particular level or sphere chosen by the researcher.</td>
</tr>
<tr>
<td>C</td>
<td>Transference of the known to a new environment. Experience of a particular level or sphere chosen by the researcher.</td>
</tr>
<tr>
<td>D</td>
<td>Transference of the known to a new environment. Descriptive narrative.</td>
</tr>
</tbody>
</table>

Creating this type of environment, teachers proceeded from the following considerations:

- Formal education promotes the environment favourable for development of research skills as one of the normative types of activity. In a formal environment, students learn what the state deems appropriate at the particular period of time. Teachers incorporate research activity in their lessons (Grishane, 2007a).
- Non-formal education opportunities proposed are diverse in their form and content – interest education hobby groups (of art, sport, creation), extracurricular activities (competitions, projects, conferences), special courses (art of philosophy, business etiquette, social relations, strategies of sustainable development, etc.). These activities create environment that integrates knowledge, develops skills and forms a habit of looking at problems from various perspectives.
- Informal education enables students to acquire life experience in communication with family, schoolmates and society in general. In research works, such experience serves as a catalyst for research of subjectively significant
phenomena and/or phenomenological processes and generates non-traditional research questions. Therefore, students begin their research by determining their opinions and personal experience and complement their personal experience with interests and life experience of diverse social groups.

(b) Teaching/Learning/Practical activity

The next environment was discovered by observing the integration of different skills applied by students. These skills were developed in (1) practical activities, and (2) mastering the theory.

Students’ educational achievements are an important indicator of the quality of teaching and learning work at school, provided that they are not considered the only aim of education. For several years the average level of students’ knowledge (indicator of objectively measurable results) is above 88% of ABC level achievement (average level of state secondary schools – 89%, average level of secondary education institutions – 64%).

Evaluation of teaching and students’ involvement in learning and practical activities reveals that the proposed activities promote the development of research skills reflected in students’ works as the research approach and means (Table 3).

Table 3. Research approaches and means in environment determined by Teaching/Learning/Practical activity

<table>
<thead>
<tr>
<th>Research approach</th>
<th>Means of learning and research</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Suggesting new assumptions and research questions. Awareness of theoretically and practically tested values.</td>
</tr>
<tr>
<td>B</td>
<td>Suggesting new assumptions and research questions. Study of the sample selected by the researcher.</td>
</tr>
<tr>
<td>C</td>
<td>Testing the hypothesis formulated in the beginning of research. Study of the sample selected by the researcher.</td>
</tr>
<tr>
<td>D</td>
<td>Testing the hypothesis formulated in the beginning of the research. Awareness of theoretically and practically tested values.</td>
</tr>
</tbody>
</table>

Practical activities proposed in the school for creation of this type of environment:

- The teaching methods are sufficiently diverse to ensure an opportunity for all students to achieve the highest possible learning results. This is confirmed by the analysis of the observed lessons (Grishane, 2007a) as well as by the stable results in state examinations demonstrated over a considerable period of time (evaluation by external experts).
- Helping students to acquire learning methods is one of the priorities. Presentation of learning methods is integrated in both formal and non-formal education activities.
- Students are engaged in practical activities during lessons (e.g. laboratory work), within non-formal education (both during special courses and projects), participating in social activities and carrying out independent research work.
(c) **Knowledge/Skills/Attitudes**

Students tend to conduct the research grounded on the exploration of research object in its natural environment and reflecting its history. Selecting research approaches and means students use knowledge, skills, and attitudes obtained in classes and transfer them to their research work.

Content analysis of research works (Grishane, 2007b) reveals students’ interest in particular disciplines and the correspondence of the choice of research topics to the educational programme mastered by the students. The activities of learning process also affect students’ choice of research topic and means. The more diverse the teachers’ work during the lessons, the more students choose to do their research in the respective discipline.

Teachers’ cooperation with students in acquiring knowledge, developing practical skills and attitudes allows for the development of research skills that are reflected in students’ work as the means of learning and research depicted in Table 4.

<table>
<thead>
<tr>
<th>Research approach</th>
<th>Means of learning and research</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Study of a phenomenon in its natural environment. Innovative suggestions for further research. Study of historical background of issue. Describing the essence of the phenomenon.</td>
</tr>
<tr>
<td>B</td>
<td>Study of a phenomenon in its natural environment. Innovative suggestions for further research. Study of knowledge (about something), convictions and/or skills. Person’s attitude towards themselves, the world and others.</td>
</tr>
<tr>
<td>C</td>
<td>Building on a particular theory. Experiment. Study of knowledge (about something), convictions and/or skills. Person’s attitude towards themselves, the world and others.</td>
</tr>
<tr>
<td>D</td>
<td>Building on a particular theory. Experiment. Study of historical background of issue. Describing the essence of the phenomenon.</td>
</tr>
</tbody>
</table>

Practical activities proposed in the school:

- Consulting students about their research works, teachers create environment in which a student realises the peculiarities and opportunities of a particular science. Part of the knowledge acquired through formal education gives an immediate return (e.g., IT, Biology, Health studies, etc.). The significance of knowledge acquired in some other subjects is revealed only with time (e.g., History, Ethics, History of Culture, Philosophy as bearers of spiritual values). Some subjects have double implications – for instance, students can perceive the Geography both as a natural and social science.
- Teachers create the possibility to engage in experimentation and analysis of obtained data. Activities and interactive teaching methods allow to enrich the individual research experience.
• To develop healthy attitudes, students have to experience conventional social relationships and comprehensive practical display of such attitudes in daily communication. This experience is obtained through collaborative culture and practice of teachers, students, and parents.

• The outcomes of attitude education that emphasises cooperation, dialogue, partnership, values education and acquisition of life skills are also integrated in students’ research works.

(d) Information/Narration/Discussion

Searching for truth, students use different questions. The means of research is linked with the research questions and how the information is interpreted. The students use the questions characteristic both for qualitative and quantitative research approaches. Following modes were used: (1) collection of information, (2) comprehension of narration, and (3) discussion in relation to students’ individual needs, interests and research skills (see Table 5).

Table 5. Research approaches and means in environment determined by Information/Narration/Discussion

<table>
<thead>
<tr>
<th>Research approach</th>
<th>Means of learning and research</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The research work answers the questions: How does it happen? How is it manifested? Interviews. Interpretation and comparison of generally accepted opinions. General adaptation of information.</td>
</tr>
<tr>
<td>B</td>
<td>The research work answers the questions: How does it happen? How is it manifested? Interviews. Learning from specific experience. Characteristics of a specific situation.</td>
</tr>
<tr>
<td>C</td>
<td>The research work answers the questions: How much? How often? Questionnaires and analysis of the data. Learning from specific experience. Characteristics of a specific situation.</td>
</tr>
<tr>
<td>D</td>
<td>The research work answers the questions: How much? How often? Questionnaires and analysis of the data. Interpretation and comparison of generally accepted opinions. General adaptation of information.</td>
</tr>
</tbody>
</table>

The school provides these modes in following way:

• The availability, amount and significance of information are ensured by updating the school’s resource basis and developing both students’ and teachers’ information processing skills. Activities in order to obtain and expose information characterise formal teaching (identified in the observed lessons), non-formal activities (e.g., special courses), and communication with family members.

• Informative narration provides students with a broad range of facts and gives an opportunity to learn about various opinions and choose criteria for formulating their own opinions. Students demonstrate a practical application of formulating, substantiating and coordinating opinions in extra-curricular activities.
• Discussion is sustained both by the availability of diverse information and by the ability to critically evaluate and analyse the obtained information, which lie at the basis of any research work. Students are involved in the national and international projects, discussions among groups of students, students and parents, students and teachers as well as in debates with politicians, municipal administration and professionals of different spheres.

(e) External conditions/Internal organisational conditions/Individual’s life environment

Analysing the links between the research approaches and needs to study the objects from different perspectives, it was determined that students tend to examine the research themes grounded in their own experience, or on the analysis of external or internal organizational conditions.

These skills appear in students’ work as the means of learning and research displayed in Table 6.

Table 6. Research approaches and means in environment determined by External Conditions/Internal organisational conditions/Individual’s life environment

<table>
<thead>
<tr>
<th>Research approach</th>
<th>Means of learning and research</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A clear focus of research. Description of daily life, individual’s problems, meaning of life. Comparison of personal opinion and theoretical verities.</td>
</tr>
<tr>
<td>B</td>
<td>A clear focus of research. Description of daily life, individual’s problems, meaning of life. Cognition, adaptation, communication, acquiring of experience.</td>
</tr>
</tbody>
</table>

Organisation of school’s environment:
• In the contemporary globalised information field, the school provides students with broad opportunities to receive the necessary information as well as to develop IT skills and engage in international networks.
• Internal organisation is structured according to the cultural model of social relations and traditions, thus permitting students to practice relationships and certain patterns of behaviour. School staff purposefully creates the circumstances allowing practically apply the rules and norms of social relations. Suggested activities develop ability to agree and assume responsibility. Social behaviour is acquired mastering the traditions and characteristic models of cultural environment.
• The more students cooperate with others in the social life of the gymnasium and beyond (through formal, non-formal and informal activities), the richer is the content of their research works. Individuals integrate the experience of others and create their own “lifeworld”.
(e) Global influence/Local influence/Individual choice

The students follow inductive or deductive perspectives in selecting the context for the research theme. They integrate these perspectives using the phenomenological or concrete experience methodology and therefore designing their individual perspective and understanding about the process or phenomenon under the research. Research skills manifested in students’ works indicated environment allowing to (1) master the global context, (2) master the local context and (3) make the individual choice joining the global and local experience.

These skills appear in students’ works as it is showed in Table 7.

Table 7. Research approaches and means in environment determined by Global influence/Local influence/Individual choice

<table>
<thead>
<tr>
<th>Research approach</th>
<th>Means of learning and research</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Research is mainly inductive.</td>
</tr>
<tr>
<td></td>
<td>Details of experience.</td>
</tr>
<tr>
<td></td>
<td>Analysis of regularities.</td>
</tr>
<tr>
<td>B</td>
<td>Research is mainly inductive.</td>
</tr>
<tr>
<td></td>
<td>Solving practical problems.</td>
</tr>
<tr>
<td></td>
<td>Study of time and/or space</td>
</tr>
<tr>
<td></td>
<td>bound experience.</td>
</tr>
<tr>
<td>C</td>
<td>Research is mainly deductive.</td>
</tr>
<tr>
<td></td>
<td>Solving practical problems.</td>
</tr>
<tr>
<td></td>
<td>Study of time and/or space</td>
</tr>
<tr>
<td></td>
<td>bound experience.</td>
</tr>
<tr>
<td>D</td>
<td>Research is mainly deductive.</td>
</tr>
<tr>
<td></td>
<td>Details of experience.</td>
</tr>
<tr>
<td></td>
<td>Analysis of regularities.</td>
</tr>
</tbody>
</table>

The school ensures the mastering of mentioned contexts in following way:

- Global influence is manifested at school as opportunity for students to acquire foreign languages and IT, get involved in international projects, and travel in virtual and real space. Learning involves the studies of processes in the world, determining factors and facts in a particular period of time and/or sphere, or researching the quantitative and qualitative capacity of global resources.

- The school proposes activities for research of local processes: studies of the community, sustaining and preserving cultural-historical traditions, involvement in practical activities. Enhancing the environment and charity campaigns enable students to learn about the needs of community and natural environment promoting awareness of values, ensuring understanding of equity, environmental sustainability and social security (education, healthcare, capacitated governance, etc.), as well as skills that enable students to enliven these values.

- Awareness of self is related to the global and local contexts and ability to perceive values, experience a sense of belonging and responsibility. Individuality is formed under the influence of family, school and society. Students identify themselves with individually significant norms and values of a particular culture and a certain lifestyle.
(f) Ecology/Integration/Spirituality

The students’ research work shows the need for the reflection on the societal development and wish to search for the solutions to improve the quality of relationships or phenomena. The interaction between the learning environment, students’ research skills and thematic contexts fosters the skills to analyse the social activities from the point of view of sustainable development. The students’ research work contained the three principles of sustainable development – ecological, integrative and spiritual principle. These principles determine the students’ individual frames of references and they are used and interpreted differently in students’ works.

Evaluation of these interpretations in the context of sustainable development revealed the means used in students’ research works (see Table 8).

Table 8. Research approaches and means in environment determined by Ecology/Integration/Spirituality

<table>
<thead>
<tr>
<th>Research approach</th>
<th>Means of learning and research</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A clear aim set by the researcher.</td>
</tr>
<tr>
<td></td>
<td>Reflection on the significance of the process.</td>
</tr>
<tr>
<td>B</td>
<td>A clear aim set by the researcher.</td>
</tr>
<tr>
<td></td>
<td>Aim – to improve the quality (of work, life, etc.).</td>
</tr>
<tr>
<td>C</td>
<td>Researcher detached from the subject of research.</td>
</tr>
<tr>
<td></td>
<td>Aim – to improve the quality (of work, life, etc.).</td>
</tr>
<tr>
<td>D</td>
<td>Researcher detached from the subject of research.</td>
</tr>
<tr>
<td></td>
<td>Reflection on the significance of the process.</td>
</tr>
</tbody>
</table>

The principles of sustainable development are applied at school using the following strategies:

- At school, the ecological principle is proposed as the rational use of resources and development of considerateness. This principle is understood by students in their research as providing ecological safety and preservation of biodiversity.
- The social aspect of integration is proposed to students as freedom of choice and respect for traditions. Students participate in discussions and activities learning the principles of just legislation, executive power and judiciary, social and intergenerational justice and developing their own frames of reference for evaluation of democratic processes.
- Spirituality develops when students reflect on and research attitude toward life and life sustaining system, relationships among people with an emphasis on moral and ethical issues – the rights of posterity to welfare, responsibility for biosphere, etc.

Each educational institution is able to create its own supply of activities grounded in the analysis of specific types of environment and the selected criteria that characterise specific means of activity. Purposeful practical activities that are part of the diversified educational process, influence students’ research skills, create and sustain interest in research and develop research experience.
Conclusion

The given research indicates three conditions determining the design of schools’ research and learning environment for secondary school students’ research activities. Each of these conditions marks three dimensions discernible in school’s research and learning activities:

(1) integration of students’ inquiry and teachers’ individual professional view into initial subjectively significant inquiry. Such an inquiry is developed from (1) the students’ individual interests and inquiry (initial selection of subjectively significant contexts and matching research intentions) and (2) teachers’ subjective perspective on students research work in secondary school based on teachers’ personal and professional experience.

Subjectively significant inquiry is open, active and reflective offer for school environment or dimension of subjective inquiry in school environment. In the research described above it was realized through the qualitative analysis of students’ research approaches, means and content as well as studying teachers’ views on research and learning environment in school. Research on subjectively significant inquiry elicited the dialogue about the research-oriented environment in gymnasium.

(2) ability of school to design the environment for coordination and complementarity of students and teachers research work. It is a search for the solutions how to offer the students possibilities to realize their subjectively significant inquiry on the one hand and give the teachers opportunity to develop their PPT on advanced school environment supporting the research and learning on other hand.

The second condition is also the invitation for teachers and students to engage in active research work and collaborative activities while designing the school environment. This collaboration and reflection on the school’s environment manifests as a dimension of identity of school’s environment. In this case the school’s environment is evaluated as a common field for the realization of students’ research work enabling the possibility to satisfy the different subjectively significant inquiries.

(3) influence of school environment on the development of students and teachers’ subjective inquiry toward the aim of sustainable development. This condition is based on the evaluation and reflection on research work. The first stage of evaluation concerns the influence of schools’ environment on the research work, second stage suggests the evaluation of the further development of this environment in a more extensive context of sustainable development. This evaluation of research and learning environment as well as the reflection connected with it can be grasped as the sustainability dimension of schools’ environment. The main task of this dimension is the evaluation of research and learning environment and outcomes of students’ research work in a context of aim of sustainable development.

The results of this analysis can be implemented by educational institutions, which organise students’ research activities. The described methods and means can be used in learning environment with no supplementary material resources required and involving teachers in research of school environment therefore re-orientating their professional frames of reference to address sustainable development.
References:


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