Online Education Resources and Student Needs: Stylistic Aspects

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Abstract

Objectives: This work continues a long-term study of the student needs and preferences by using open network education resources oriented to online support of the educational process. Methods: The importance of online education resource components has been determined by pedagogical university students using the method of paired comparisons from two points of view – that of the student and that of the teacher (corresponding to learning/teaching stylistics). Findings: During the study: a) a comparative analysis of the stylistic characteristics of the respondents in 2011 and 2016 has been undertaken and changing attitudes of future teachers to the teaching stylistics from “expert” to “facilitator” have been revealed; b) the importance of resource components in physics correlated with their stylistic features has been defined; c) the prevailing learning and teaching styles of open network education resources, affecting the efficiency of user training, have been identified; d) arguments in support of taking into consideration student’s stylistic preferences at the design stage of education resources have been posed. These methods of studying stylistic peculiarities of Internet education resources are unique, and the authors are interested in discussing the results. Applications/Improvements: Consideration of the diversity of the student audience needs allows adapting the learning resources to rapidly changing conditions of the educational process. The results can be used to improve the efficiency and comfort of online self-study process.

Keywords: Learning and Teaching Styles, Open Network Education Resources, Student’s Stylistic Preferences, Stylistic Aspects of Open Network Education Resources

1. Introduction

Students are the future of the nation, the intellectual and the active potential of this part of society cannot be overestimated: the quality of their education in a variety of shapes and variations in the future affects the quality of life of society, and the quality itself largely depends on the optimization of the educational process with the compulsory consideration of students’ needs.

Recent years have witnessed the degree of immersion of students in the internet environment which has almost reached limit values (97-100%)\(^1\), to which the policy of training institutions further contributes that is aimed at ensuring maximum access to the Internet, including Wi-Fi in student classrooms, libraries, dormitories\(^2\). Simultaneously explosive growth of the education market takes place, which is projected should increase by another 25% in 2016 according to Docebo marketing corporation report\(^4\). Modern online resources lately are not only a repository of educational information, they support and monitor the processes of learning and teaching, and their results, organize instrumental environment for research, simulation, collaboration. However, the published results of analysis of education at mass open online courses\(^5\) show that only 6.7% of the initial number of students reach their completion that can be attributed to both the degree of involvement in the learning process lower than that in the full-time training, and non-correspondence of the process itself to expectations and needs of the main consumers of educational services – students. In other words, the level of adaptability of Internet resources to the needs of the student user is of great importance for their successful use, including cognitive, psychological, aesthetic

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preferences and stylistic aspects, which indicates the necessity to address subtler needs of consumers of educational services with the “pure” form of education in the network and its mixed versions. Among these needs are: satisfaction with the visual design of the resource, streamlining of structure and navigation, readability; emotional enthusiasm and desire to work; the credibility of the resource; and, the parameters of resource usability, determine its usefulness and comfort of use; stylistic match with expectations and preferences of the user.

In the work has been shown that an important role of the attractiveness of Open Network Education Resources (ONER) is an account of users’ preferences of the organization of the educational process, the totality of which accumulates a category of “style” – a style of teaching and learning.

2. Research of Stylistic Aspects of Learning and Teaching using Open Network Education Resources: Methods

The introduction of network education resources in its traditional and mixed forms in the educational process as intermediaries acquired almost mandatory, regulated by modern standards nature. While studying the options of using traditional hardbacks or paperbacks and the Internet in the educational and research work it was found that for the majority of teachers and students, the primary motive for accessing the Internet were convenience and speed (82.91%), utility (80.05 %) and free access to information and software (71.4%). In addition, teachers have found that the use of the Internet helps them to a greater extent to adapt the learning process to the needs of each student. This may mean that in solving stylistic conflicts of learning the online resources can be a very productive factor. However, the resources themselves can be expressed in varying degrees of stylistic orientation.

The term “learning style” appeared in publications more than 40 years ago, however, with significant intervals there are quite intense debate initiated, the meaning of which is as follows:

- whether there are styles that determine the effectiveness of training, which can be measured and taken into account for the purpose of improving the quality of the educational process;
- which styles are preferred for successful learning;
- if one should seek stylistic coincidence in education or it will lead to one-sided development of students.

A number of studies allow giving the original sound answers to these questions. Thus, argued that the stylistic conflict when learning may cause scattering of the audience’s attention for no apparent reasons, a chronic failure of certain students in the current and final control activities and, as a consequence, a decline in their self-esteem, as well as reduction of interest in the subject. Our research allows stating that the degree of stylistic components inherent to the participants of the educational process and computer training facilities, is enough measurable, in addition, their statistics specifications are subject to regular changes, and the need for representation of learning style, for example for software for educational purposes can appear when the student lacks them himself.

In a broad sense, the implementation of the learning process is at the intersection of latent stylistic characteristics of trainees and trainers (the role of the latter can be performed by both teachers and software pedagogical tools and/or educational online resources mediating their function). The structure of emerging of styles of the educational process participants is shown in Figure 1. In the scheme, the presence of square brackets indicates...
that this stylistic expression is an array, i.e. it has its own descendants in classification. A detailed description of stylistics types and groups presented in Figure 1 is given in works\textsuperscript{16,19} and bibliographic sources. Areas highlighted in gray mark styles the expression of which is characteristic not only for real teachers, but also for e-learning means, including stand-alone and network software resources for educational purposes. Thus, the focus of this article review is of teaching and learning styles.

The presence of their own style (or combination of styles) at such funds is explained due to the inevitable and natural inheritance of creation of the authors/developers’ individual or collective style. Areas distinguished in Figure 1 embrace the components of the organizational-role element of teaching styles and learning styles (for the student) which are directly related to the tactical and strategic types of lesson style organization. In the e-learning tools these styles are manifested in:

- choosing formats and methods of systematization of necessary and sufficient teaching materials;
- presentation and design style;
- set of functions;
- determining the proportions between the presented materials and testing procedures;
- correlation of formal declarative theoretical, illustrative materials; practical examples, models, demonstrations, etc.;
- the degree of adaptability;
- means of organization of the direct and the hidden dialogue;
- the degree of interactivity;
- the “loyalty” resource – it is an opportunity to control and to manage the learning process by the student himself, as well as an adequate response to the “problem” actions of the user (this relates both to the problems arising from the use of the resource, and educational failure of a trainee).

3. Results and Discussion

In this paper an attempt to find out which resources components (associated with specific learning and teaching styles) are most important for their effective use in the learning process has been made. The respondents were the future teachers of physics and mathematics (full-time students of the Institute of Natural, Mathematical and Technical Sciences, Lipetsk State Pedagogical University) that are their real consumers both as learners and educators. It is with these two positions that the students were asked to rate the importance of a number of components with the use of AHP Online Calculator – an online decision-making tool by pair wise comparisons\textsuperscript{20}. We note that at a preliminary stage in the course of “brain-storming”, groups of respondents have identified ONER components significant for effective teaching physics, then they have been assigned to one of the styles in accordance with its characteristics.

Table 1 presented learning styles and corresponding to them ONER components, significant from the point of view of the student as a learner. Two components correspond to each teaching style.

In each pair of components under consideration, the students determined the degree of significance superiority of one as regards the other for the solution of pedagogical problems in teaching physics. With the same significance of the parties in the pair, a figure of one has been proposed. AHP Online Calculator automatically builds a matrix of elements for the decision-making, and defines priorities, i.e. it ranks components according to their place in the ranking.

Mean priority values for each of the ONER components in assessing the degree of their importance from the student’s point of view are shown in Table 2.

Similarly, the significance of the ONER components from the point of view of the teacher has been evaluated (Table 3). In this case 6 components have been considered corresponding to three styles of teaching: “Expert”,

<table>
<thead>
<tr>
<th>Learning style</th>
<th>significant components</th>
</tr>
</thead>
<tbody>
<tr>
<td>T theoretical (research)</td>
<td>extensive and well-structured theoretical material</td>
</tr>
<tr>
<td></td>
<td>abundance of charts, diagrams, both in theoretical materials, and the jobs of diagnostic modules</td>
</tr>
<tr>
<td>C cogitative (creative)</td>
<td>emphasis to the increased complexity of tasks</td>
</tr>
<tr>
<td></td>
<td>illustrations, animations and demonstrations on topics</td>
</tr>
<tr>
<td>A Active</td>
<td>description of algorithms and approaches to solving tasks</td>
</tr>
<tr>
<td></td>
<td>interactive models and laboratory work</td>
</tr>
<tr>
<td>P pragmatic (experimental)</td>
<td>examples of law effect</td>
</tr>
<tr>
<td></td>
<td>Description of experiments and experimental data processing methods</td>
</tr>
</tbody>
</table>
“Personal example model” and “Facilitator” (by two components corresponding to each style). Based on the analysis of the main characteristics of each of the teaching styles (or training ones) and results obtained in works showing greater affinity of manifestations of some related styles of education resources, we have combined “Expert” styles “Expert + Formal authoritarian” and “Facilitator” – “Facilitating + Delegating” style into one group. Brief description of the resulting style groups is shown below.

- **Expert (E)** – a high level of representation of knowledge, the precise organization of information transmission and control of its absorption. Orientation – the use of well-proven and well-established methods and forms of education, demands on the ability to apply knowledge and skills, development of basic activity algorithms for the subject.

- **Personal example model (PE)** – training on examples and analogies in the “do as I do” mode, purposeful formation of stable and conscious means of action and solving of educational problems.

- **Facilitator (F)** – stimulation of cognitive needs and the promotion of initiatives, advisory support of training, organization of access to the necessary additional materials. Orientation – support for students’ independent work and motivation for self-development.

The quality of the obtained results can be judged from the average value of the CR parameter (relative consistency of the matrix of pair wise comparisons, characterizing its convergence), which was equal to 5.2%, indicating a fairly responsible and competent expert work of the respondents (CR should be <10%).

Obviously, according to the students’ estimation from the perspective of those who are taught, and future teachers, the highest priority have ONER components oriented on learners’ practical activity, which complies with the FSES requirements and the need to prepare for the state final examination.

Now it would be interesting to determine whether the stylistic properties of real education resources correspond to the identified preferences.

To perform the estimation, seven popular open network resources focused on supporting training on physics have been selected:

1. All-fizika.com http://www.all-fizika.com/
2. alleng.ru http://www.alleng.ru/edu/phys.htm
3. fizika.ru http://www.fizika.ru
4. COOL! PHYSICS http://www.class-fizika.narod.ru/

### Table 2. Evaluation of the importance of ONER components from the viewpoint of the student

<table>
<thead>
<tr>
<th>Component (property)</th>
<th>The degree of preference, % (average value)</th>
<th>Compliance with the style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of algorithms and approaches to solving tasks</td>
<td>17.9</td>
<td>A</td>
</tr>
<tr>
<td>Description of experiments and experimental data processing methods</td>
<td>14.3</td>
<td>P</td>
</tr>
<tr>
<td>Examples of laws</td>
<td>14</td>
<td>P</td>
</tr>
<tr>
<td>Focus on the solution of high complexity tasks</td>
<td>14</td>
<td>C</td>
</tr>
<tr>
<td>Extensive and well-structured theoretical material</td>
<td>11.6</td>
<td>T</td>
</tr>
<tr>
<td>Interactive models and laboratory work</td>
<td>9.7</td>
<td>A</td>
</tr>
<tr>
<td>Availability of graphs, charts, diagrams, both in theoretical materials, and in the tests.</td>
<td>9.3</td>
<td>T</td>
</tr>
<tr>
<td>Illustrations, animations and demonstrations on topics</td>
<td>8.1</td>
<td>C</td>
</tr>
</tbody>
</table>

### Table 3. Evaluation of the importance of ONER components associated with the styles of teaching

<table>
<thead>
<tr>
<th>Noser. no</th>
<th>Component (property)</th>
<th>The degree of preference, % (average value)</th>
<th>Compliance with the style</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>There are examples of tasks analyzed and works of design templates</td>
<td>25.3</td>
<td>Personal example model (PE)</td>
</tr>
<tr>
<td>2</td>
<td>The existence of direct guidance and instructions for laboratory work and solving problems</td>
<td>19.4</td>
<td>Expert (E)</td>
</tr>
<tr>
<td>3</td>
<td>Extensive reference database (constants, properties, terminological dictionaries and indices)</td>
<td>15.9</td>
<td>Expert (E)</td>
</tr>
<tr>
<td>4</td>
<td>Availability of tests for express diagnostics of training success</td>
<td>15.4</td>
<td>Personal example model (PE)</td>
</tr>
<tr>
<td>5</td>
<td>The opportunity to get online assistance or clarification</td>
<td>14.5</td>
<td>Facilitator (F)</td>
</tr>
<tr>
<td>6</td>
<td>The presence of annotated links to other websites as sources of educational materials</td>
<td>9.5</td>
<td>Facilitator (F)</td>
</tr>
</tbody>
</table>
5. aYp.ruportaL http://fizika.ayp.ru/

In the selection of the resources the following criteria have been taken into account: free access; attendance; a variety of components; user reviews.

Respondents have been asked questions, implicitly defining the inclination of the corresponding education resource to a particular style of learning and teaching.

Defining the dominant ONER style of teaching, respondents noted the presence or absence of 16 signs according to the binary system: the presence of a component have been marked as 1, and its absence – as 0. The symbols in brackets refer to the learning styles described above:

1. Extensive theoretical material (T).
2. Summary of the themes in the form of clear definitions, wordings of the laws, regulations and their connections (C).
3. Theoretical materials are provided for reference purposes, performing functions of assistance or tips for solving problems or laboratory work (R).
4. The presentation of theoretical material resembles the basic scheme, or cheat sheet (A).
5. A large number of practical tasks (exercises, tests) (A).
6. Presence of exercises of experimental nature or requiring analysis of empirical data, the evaluation of effect intensity in the required conditions (P) based on results of the experiment.
7. Preference is given to high-quality exercises, of logical nature, not requiring numerical answer (T).
8. Exercises are of problem nature or have a non-standard language as regards the form and the content (C).
9. Many examples of law effect from surrounding reality (P).
10. Presence of instructions or algorithms for performing each step of a new kind of tasks (A).
12. Emphasis on the history of discoveries and inventions (C).
13. Presence of tools to create and work with interactive models (A).
14. Possibility of change in interactive model parameters over a wide range to obtain the desired effect (C).
15. Possibility of observing the processes in the dynamics (animation) by reference to physical laws, the availability of dynamic scheme (T).

Table 4 shows the values of the normalized frequency of positive evaluations (1) for each of 16 signs.

Numbering in the first column of the table corresponds to the position of feature in the list. Gray filling in the table denotes the identifying features of more than 60% of respondents. Thus, educational resources under consideration are characterized by the predominance of the theoretical material presented in the form of clear definitions and language of laws, concepts and rules, and accompanied by a large number of graphs, charts, diagrams, etc. Taking into account the data in Tables 2, 3 and 4, it can be said that users expect from an educational resource more focus on practical activities, theoretical material holds the fifth place in importance.

The dominant style of ONER under investigation is theoretical; and only All-fizika and fizika.ru resources are focused on pragmatic style of teaching.

The style of teaching of ONER has been determined by the method based on the 5-point estimation of degree of manifestation of 18 components that characterize a particular teaching style:

1. Availability of guidelines and instructions on the nuances.
2. Evidence of a learning trajectory given by scenario resource.
3. Examples of laws and dismantled exercises.
5. Presence of guidelines within specific algorithms.
6. Step by step instructions for solving problems of this type.
7. The central place occupied by the basic formula and reference materials.
8. An opportunity for the student to choose themes and actions (for example, a test) by himself, to determine the learning trajectory.
9. Most of the examples are accompanied by explanations.
10. The possibility to see the results of actions performing the virtual laboratory and training work.
11. The ability to model, design the physical situation.
12. Basically laws and regulations aimed at creating a common approach to the solution of physical problems are stated. Availability of exercises for self-fulfillment
Table 4. Normalized assessment of frequency of appearance of 1 in assessing the presence of ONER attribute (learning styles)

<table>
<thead>
<tr>
<th></th>
<th>All-fizika</th>
<th>alleng.ru</th>
<th>fizika.ru</th>
<th>COOL! PHYSICS</th>
<th>aYp.ruportal</th>
<th>Interactive physics</th>
<th>Physics for you</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.89</td>
<td>0.85</td>
<td>0.96</td>
<td>0.89</td>
<td>0.93</td>
<td>0.78</td>
<td>0.85</td>
</tr>
<tr>
<td>2</td>
<td>0.74</td>
<td>0.37</td>
<td>0.85</td>
<td>0.93</td>
<td>0.93</td>
<td>0.63</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>0.78</td>
<td>0.44</td>
<td>0.78</td>
<td>0.89</td>
<td>0.3</td>
<td>0.63</td>
<td>0.37</td>
</tr>
<tr>
<td>4</td>
<td>0.67</td>
<td>0.57</td>
<td>0.78</td>
<td>0.59</td>
<td>0.52</td>
<td>0.48</td>
<td>0.3</td>
</tr>
<tr>
<td>5</td>
<td>0.63</td>
<td>0.56</td>
<td>0.96</td>
<td>0.74</td>
<td>0.15</td>
<td>0.33</td>
<td>0.53</td>
</tr>
<tr>
<td>6</td>
<td>0.59</td>
<td>0.04</td>
<td>0.74</td>
<td>0.59</td>
<td>0.15</td>
<td>0.59</td>
<td>0.41</td>
</tr>
<tr>
<td>7</td>
<td>0.26</td>
<td>0.74</td>
<td>0.52</td>
<td>0.04</td>
<td>0.52</td>
<td>0.07</td>
<td>0.33</td>
</tr>
<tr>
<td>8</td>
<td>0.37</td>
<td>0.19</td>
<td>0.52</td>
<td>0.59</td>
<td>0.07</td>
<td>0.33</td>
<td>0.33</td>
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<tr>
<td>9</td>
<td>0.7</td>
<td>0.11</td>
<td>0.81</td>
<td>0.81</td>
<td>0.37</td>
<td>0.63</td>
<td>0.22</td>
</tr>
<tr>
<td>10</td>
<td>0.33</td>
<td>0.04</td>
<td>0.56</td>
<td>0.52</td>
<td>0.07</td>
<td>0.15</td>
<td>0.37</td>
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<tr>
<td>11</td>
<td>0.67</td>
<td>0.11</td>
<td>0.81</td>
<td>0.85</td>
<td>0.63</td>
<td>0.85</td>
<td>0.56</td>
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<tr>
<td>12</td>
<td>0.63</td>
<td>0.11</td>
<td>0.48</td>
<td>0.74</td>
<td>0.11</td>
<td>0.52</td>
<td>0.04</td>
</tr>
<tr>
<td>13</td>
<td>0.33</td>
<td>0.04</td>
<td>0.33</td>
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<td>0.44</td>
<td>0.15</td>
<td>0.15</td>
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<tr>
<td>15</td>
<td>0.48</td>
<td>0.04</td>
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<td>0.81</td>
<td>0.11</td>
<td>0.96</td>
<td>0.63</td>
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<tr>
<td>16</td>
<td>0.89</td>
<td>0.0</td>
<td>0.81</td>
<td>0.37</td>
<td>0.15</td>
<td>0.52</td>
<td>0.33</td>
</tr>
</tbody>
</table>

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13. Training based on the proprietary methodology, availability of peculiar exercises.
14. Each section concludes with control issues or thematic testing.
15. The possibility of feedback on the site when difficulties arise.
16. Developed search tools for terms, names of scientists, effects and phenomena
17. Analysis of students’ common mistakes with specific examples.
18. Instructions for solving tasks are accompanied by detailed explanations of these actions feasibility.

Components 2, 5, 7, 12, 16, 18 characterize the “Expert” style; 1, 3, 6, 11, 13, 17 – “Personal example model”; 4, 8, 9, 10, 14, 15 – “Facilitator”. Change of assessment method is due to the fact that these components are present in ONER to varying degrees.

In addition, respondents were asked to make a subjective assessment of the degree of job satisfaction with the resource (consumer qualities of ONER) due to the five-grade scale: “ease of use”, “beneficial for teaching”, “attractiveness of design”. To assess ONER dominant stylistic orientation the average score for each style of teaching has been determined. The results are shown in Table 5, the signs correspond to each style of teaching: E – “Expert”, F – “Facilitator”, PE – “Personal example model”; for subjective assessments: U – “Usability”, LU – “Learning Usefulness”, DA – “Design attractiveness”.

Attraction of ONER to one of the teaching styles has been determined by the highest mean score (bold selection in Table 5). The results presented in Table 5 are summarized in Figure 2.

Obviously, in the ranking of teaching styles “Expert” prevails according to the frequency of manifestation and the absolute average score – 5 out of 7 ONER; the second place is taken by “Facilitator”, then – “Personal example model”.

At the final stage of the experiment, we tried to establish whether there is a relationship between the stylistic features and subjective assessments of satisfaction with the use of education resources, for which the coefficients of the linear Pearson correlations have been determined. It turned out that there is an almost unique relationship between estimates of stylistic components of the “Expert” and the category of “Learning Usefulness” ($r = 0.902$) (which is consistent with observations in work 6), interdependence between the assessment of the “Facilitator” style and usability ($r = 0.661$) is less pronounced. With the number of respondents $n = 72$, and a significance level of $p = 0.01$, the critical value of the Pearson coefficient is equal to $r_{cr} = 0.306$. 
Table 5. Average estimations of ONER teaching styles

<table>
<thead>
<tr>
<th>Style</th>
<th>All-fizika</th>
<th>allen.ru</th>
<th>fizika.ru</th>
<th>COOL! PHYSICS</th>
<th>aYp.ruportal</th>
<th>Interactive physics</th>
<th>Physics for you</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>2.715</td>
<td>1.85</td>
<td>2.55</td>
<td>2.72</td>
<td>2.10</td>
<td>2.02</td>
<td>2.05</td>
</tr>
<tr>
<td>F</td>
<td>2.267</td>
<td>1.68</td>
<td>2.34</td>
<td>2.62</td>
<td>1.46</td>
<td>2.04</td>
<td>2.09</td>
</tr>
<tr>
<td>PE</td>
<td>2.105</td>
<td>1.01</td>
<td>2.52</td>
<td>2.27</td>
<td>1.46</td>
<td>2.17</td>
<td>1.85</td>
</tr>
<tr>
<td>U</td>
<td>3.67</td>
<td>2.67</td>
<td>4.14</td>
<td>3.48</td>
<td>3.62</td>
<td>3.81</td>
<td>3.48</td>
</tr>
<tr>
<td>LU</td>
<td>4.62</td>
<td>2.95</td>
<td>4.81</td>
<td>3.86</td>
<td>3.33</td>
<td>3.91</td>
<td>3.57</td>
</tr>
<tr>
<td>DA</td>
<td>3.76</td>
<td>2.29</td>
<td>4.48</td>
<td>3.86</td>
<td>3.00</td>
<td>3.81</td>
<td>3.57</td>
</tr>
</tbody>
</table>

Figure 2. Average estimations of ONER teaching styles

Comparing these results with those obtained in works,\textsuperscript{6} we can see that the style dominants are largely determined by the subject functioning area of the resource. The ONERs focused on ICT-disciplines are characterized by the predominance of “Expert” and “Personal example model” styles. Customers interested in information technologies prefer the availability of examples of implementing technological solutions, step by step instructions to perform tasks; it is important for them to see the results of implementation of software code in the resource built-in mini-browser. Apparently, the features of the “Expert” style always generate a subjective feeling of usefulness of the resource for learning, therefore the majority of resources applied for a universal (in the methodical meaning) use should be guided by the embodiment of this style features to the fullest. Another explanation is possible: the “Expert” style is the base for traditional textbooks, and ONERs inherit their orientation.

3.1 Investigation of Learning and Teaching Styles of the Respondents Themselves

Research of learning and teaching styles of LSPU students has been conducted by the authors repeatedly. In 2011, it was established\textsuperscript{16} that the predominant style of teaching students (60% of respondents) is the “Thinkers” (cognitive) or the style of reflective observation, the possessors of which prefer a thorough consideration of problems and ways of their solving to the action. The other 40% of the respondents have been distributed as follows: 19% of respondents were the owners of mixed learning style, 12% – “Activists”, 6% – “Theorists”, the rest – “Pragmatists”.

To determine the degree of stability of the teaching style, students have been interviewed twice: before and after teaching practice. The results indicate a change in the degree of manifestation of students’ teaching styles as a result of the prolific professional and teaching activity. We have established a kind of “shift of styles” from the “Formal authoritarian” (71%) to the style of “Personal example” (92%), which, to the authors’ assumption, could be due to the intensive use of educational software (locally and on-line) and ICT by trainees.

Conducting another study of learning and teaching styles, the\textsuperscript{16,17} were able to compare the results of 2011 with the current stage of research. The survey involved 72 students of the Institute of Natural, Mathematical and Technical Sciences of LSPU. Techniques of survey and processing the results used, described in detail in,\textsuperscript{16,19} have been applied without significant changes. The distribution of respondents’ learning styles is represented on the histogram (Figure 3). “Thinkers”, as in 2011, are in the lead among the other styles. However, this is not the vast majority, only 47% of respondents are referred to this group. By 2016, the proportion of those practicing the “Theorists” learning style has increased and is 25%, the proportion of “Activists” has remained the same – 12%, the owners of mixed style are 16%; the pronounced “Pragmatists” among respondents are absent. The conclusion is as follows: the future teachers of physics and mathematics are poorly focused on practical research.

The latter result is in contradiction with the outlined transition from knowledge to activity-oriented approach,
Online Education Resources and Student Needs: Stylistic Aspects

affecting the learning process in general and the attitude of its participants to education resources. Programs of subjects in school are focused on the active use of not only e-applications to textbooks and teaching aids, but also the use of electronic Open Network Education Resources (ONER) of global network. The latter are intended not only for teachers’ working themselves up to lessons, but also for students’ independent work.

The introduction of the second generation of FSES to school influenced the manifestation of styles of training future teachers of physics and mathematics. During the examination, held in 2011, the predominant style of teaching students was “Expert”. This style is characterized by the demonstration of significant dominance of the knowledge of the teacher, seeking to convey this knowledge to students, ensuring their high level of training. It was natural in the situation when the main aspect of the teaching methods at school was transfer of teacher’s knowledge to students and the formation of skills on their basis.

Surveys of 2015/2016 academic years showed that the “Facilitiator” style is predominant (Figure 4).

The bar chart on the x-axis shows the abbreviation of styles. E – “Expert”: the predominance of this style suggests considerable knowledge and experience of its owner, which focuses on the transmission of information, ensuring good training of students. FA – “Formal-authoritarian style” refers to the combination of well-deserved high status of its owner with strict requirements to comply with the rules specified during the training: development of skills of the standard ways of life and adherence to conventional learning algorithms, the desire for maximum performance. PE style – “Personal example model” indicates the teacher’s orientation on the use of workshops (training on examples and demonstrations), the promotion of students’ attempts to repeat activities and go beyond them, in this case the teacher constantly monitors and controls training activities. “Facilitiator” style (F) in accordance with its name communicates the trainees with the broader information environment. It advises and guides them, asking questions, offering alternatives, indicating the problems, encourages students to make a conscious choice of tactics and learning strategies, providing maximum support and encouragement. Teachers with the dominant style of “Delegator” (D) aim to “teach students to learn” with an emphasis on independent work, the formation of ability to self-esteem by organizing the necessary consultations, control and diagnostic activities. “Mx” denotes the mixed style; these are people that cannot be uniquely identified by the predominance of a single teaching style, they often possess two styles close to each other, such as Expert and Formal-authoritarian, Facilitiator and Delegator, etc.

Two main obvious results are worth noting. Firstly, the attitude towards the formal-authoritarian style of teaching has remained unchanged – none of the respondents have proved to be prone to it. Secondly, the ratio of respondents that are media of the teaching styles of “Expert” and “Facilitiator” changed diametrically opposed. In 2011 respondents had the “Expert” style of teaching as predominant, in 2016 – that of “Facilitiator”. In this case, the paradigm of the activity-oriented approach to teaching may “work” that places the problem over the teacher “to teach students to learn”, that is to gain knowledge on one’s own, relying on the teacher’s guiding role. Perhaps changing tools used to support learning at university and school (during teaching practice) have influenced the formation of the respective stylistic components of students referring to this sample. It is also possible to influence modifying the teaching style presupposing changing the role of the teacher from the “main media” and transmitter of educational information to the “consultant” and “controller” in the light of the increasing role of online learning.
4. Conclusions

Current trends and user’s preferences in the field of online education largely determine the direction of the efforts of theoreticians and practitioners in the future. However, in terms of the demographic reality it is necessary to exactly meet the unique needs of students and generate understanding of which factors are significant for increasing the effectiveness of training in the priority groups. According to the authors, the attractiveness of ways to organize any form of training depends on many factors, but not the last, though the least known of which is the consideration and implementation of the stylistic characteristics of the trainees and the relevant style parameters (aspects) of the educational process.

The results of the present study allow stating that the question of the existence of stylistic manifestations in the learning process is not rhetorical; styles are measurable, they are changing under the influence of the learning environment and are one of the factors determining the choice of educational resource by the teacher or by the student.

The study has revealed that:

1) one of the consequences of information of training the future teachers of physics for professional-pedagogical activity is the change in students and teachers’ attitude to the teaching style, which is now focused on leadership and advisory function of the teacher;
2) the most important components of the electronic open educational resources are those that involve active practical work of students, the ability to orient by themselves in the work with the resource;
3) the predominant ONER teaching style is “theoretical”, which gives the students the ability to self-produce reliable and comprehensive information on the academic subject, but does not meet the growing needs in the practice-oriented learning environment;
4) the predominant style of teaching is “Expert”, which means high quality and careful selection of media and components, allowing the use of a resource in the educational process. This fact has its roots in the traditional method of education, but it cannot be considered as negative – according to the apt remark, “some teaching styles often lead to better results than others, regardless of the style of learning proper to the students”.

It should be noted that there have been quite critical statements about the need to consider the style in teaching recently. According Ph. M. Newton, “learning styles may be the educational equivalent of homeopathy: the medical term for which there is no existing evidence, however, for which the faith and the use remains”. In fairness, we note that most of the works in which the link with the consideration of the style is confirmed or denied (rather it is a direct stylistic conformity), were associated with the study of information coding styles. In this direction, stylistic corresponding at training may appear rather harmful because it leads to the consolidation of the preferred methods of obtaining information (visual, auditory, kinesthetic), which prevents the student’s harmonious development during the training.

As for the styles of teaching and learning the situation is different. These styles, as has been shown, are formed in the learning process, influence the choice of educational tools, resources, materials of not only the individual student, but also of quite large groups of students.

Observed by us students’ expressed preferences in the availability of certain components of the resource, associated with the stylistic trend and also the trends of changing the styles of learners themselves, suggest that the informatization of education may amend the thesis of “homoeopathicity” of stylistic aspects. Apparently, many of the criticisms are mainly due to the complexity of solving stylistic problems. When implementing e-learning programs, it is appropriate and possible to take into account the style preferences of the target audience at the ONER design stage.

In our view, the definition of style orientation of the subjects and objects of the educational process is aimed at not dogmatic adherence to certain principles and rules of the styles. On the contrary, such work is focused on keeping the infinite variety of needs, and the results of the study can be used to detect the dynamics of the very “thin” needs of users, especially in the field of education, which are associated with the “courtesy” of resources, allow harmonizing their use, and make learning if not much better, but much more comfortable.

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