

## About the journal *Physics in Higher Education*

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The Editorial Board of the journal *Uspekhi Fizicheskikh Nauk* (*Physics-Uspekhi*) took the decision to publish its response to the performance of the journal *Physics in Higher Education*. *PHE* is one among a few journals which deal with the general problems of physics — including world-outlook and philosophical issues — while also addressing the methodical aspects of teaching physics in higher educational establishments.

This bibliographic notice is not the first one of such a kind. The February 2000 issue of *Physics-Uspekhi* [Vol. 43 (2) 211 (2000)], for example, offered an analysis of papers on physics published in the *Soros Obrazovatel'nyi Zhurnal* (*Soros Educational Journal*). We should say at the outset that the two journals are quite different in the size and make-up of their intended audience. The circulation of the *Soros Educational Journal* reaches tens of thousands (40,000 in 1995–1998, and 30,000 in 1999). With the *Physics in Higher Education*, it is only a few (but not more than five) hundred, and its copies are mainly disseminated by subscription. While primarily intended for school teachers and pupils of higher forms, the *Soros Educational Journal* has in fact a much broader audience: it is sent free of charge to college and university libraries and enjoys popularity among undergraduate and post-graduate students as well as among scientific workers and the teaching staff. *Physics in Higher Education* addresses specifically instructors in higher educational institutions.

The Editor-in-Chief's front-page article in the first issue of the journal (Vol. 1, No. 1, 1995) says: “The basic aims of this journal are to be a vehicle of communication for college and university physics departments and to provide higher-school scientific and research communities with up-to-date information on major developments in general teaching policy and on higher education events and activities. It is our hope that ... the journal will be filled with lively and interesting material relying on the original methodical findings of practising instructors and adding fresh insight into the classical problems of natural sciences. ... The journal may become a forum for the discussion of the challenging problems of modern physics, which, as practice shows, often is the shortest way to the deep understanding of the foundations of any science”.

A few formal facts now. The journal was founded in 1995. It appears quarterly. As of the beginning of 2002, 26 issues totalling about 400 printer's sheets had been published. The journal's founders are the Ministry of Education of the Russian Federation, the Moscow Physical Society, and the Russian Research and Production Association ‘Rosuchpribor’, — the Ministry of Education's leading organization specialized in producing the learning tools and distributing them among educational institutions.

The journal's Editor-in-Chief is Academician Oleg Nikolaevich Krokhin. The Editorial Board, along with a number of prominent scientists and leaders of major physics-oriented colleges and universities, also includes experienced instructors, methodists, the representatives of the founding organizations, and a number of foreign specialists.

In the issue No. 4 for 2001, the main sections of the journal were titled as follows.

(1) Conceptual and methodical problems of teaching a general physics course in higher educational establishments, technical schools, and colleges.

(2) Problems of teaching a general physics course in technical universities.

(3) Modern laboratory practical work in physics.

(4) Lecture demonstration experiment.

(5) Methods of audio-, video-, and computer teaching.

(6) Problems of teaching a general physics course in pedagogical institutes and special secondary educational institutions.

(7) Current practice of small-scale physics experiment.

(8) General physics course in relation to other disciplines.

(9) Integration of higher school and the Russian Academy of Sciences.

(Notice that, so titled, the first eight sections were already announced in the first issue of the journal in 1995)

These headings apparently had not yet become permanent at the time because in the Executive Editor's introductory article in the same No. 4, 2001 issue the sections are named somewhat differently: ‘Issues in the history of physics’, ‘Methodical issues’, ‘Methods for arranging the student's individual work and monitoring the students' attainment’, ‘Topical problems of physics laboratory practical work’, and ‘The use of computer technologies’.

In another issue (Vol. 2, No. 3, 1996), the section titles are as follows: ‘General issues of physics education’, ‘Physics as the basis for professional activity’, ‘Physics in the system of engineering education’, ‘Physics for natural science disciplines’, ‘Physics for humanities’, ‘Physics in the system of general secondary education’, ‘Design of pedagogical courses in the field of physics education’. Under these circumstances, the reader's search for a particular paper is hampered not only by the journal's vague structure but also by the fact that the section titles often appear only in the middle of the journal, before the opening paper of a particular block — rather than on the cover contents page, where the page numbers are indicated.

This not so important story about section heading is meant to show that the journal is still in its formation stage. This is true of the journal's content, design, and the quality of the papers. Our feeling is that the journal is continually perfecting its editorial policy, is searching for its reader and subscriber, and is intensely cooperating with its authors and founding organizations.

To get a feeling of the journal's ‘portfolio’ problems, it suffices to note that almost half of all its issues (12 of 26) are fully devoted to such things as conference proceedings

(‘Physics in the System of Modern Education’ conference, 4 issues, and ‘Modern Physics Laboratory Practical Work’ conference, 4 issues), the special-purpose Federal Program ‘State Support for the Integration of Higher Education and Basic Science’ (2 issues), and education experience at the Moscow Institute Physics and Technology and the Special Physics Department of the Moscow Engineering and Physics Institute (2 issues). Besides, even in the ordinary issues much space is allocated to information and advertizing materials and for the organizational details of scientific conferences (organizational committee make-up, application forms, fee payment bank accounts, etc.). The logic behind this selection of materials is hard to penetrate indeed.

In writing this paper we relied in part on materials prepared by *PHE*’s deputy Editor-in-Chief A D Sukhanov. In particular, he writes: “The journal’s publishing policy covers not only papers on the scientific and methodical aspects of teaching physics in higher educational institutions but also those on the most general top-on-the-agenda directions in science of physics. It should be noted that other periodicals in the field of physics are not oriented toward this kind of papers, in fact making *PHE* the only all-Russia forum for this field today”.

It is worth noting here that *Physics – Uspekhi* also tries to publish papers on general and topical directions in physics. In particular, its ‘Methodological Notes’ section speaks directly to university and college teachers. There is also a science and methodology periodical named *Physics Teaching in Higher School*. So can we really speak of *PHE* as the only all-Russia forum for this field? Clearly, to have more than one journal devoted both to general topical questions and methodical issues is beneficial because fair competition only serves to promote professional growth. It appears, after all, that it is not the subject matter which determines the reputation of a journal — but rather quality papers by the authors who are active in scientific work and who combine a talent of a teacher with that of popular science writing.

The number of such papers has definitely increased in the last issues of the journal reviewed. That the journal has grown considerably in the last seven years is quite obvious. Today, there are more authors who submit quality papers on a regular basis, the journal’s readership has broadened, and its design has improved. Therefore, the journal as a whole is difficult to evaluate: each issue is distinctive, and even papers in one and the same issue differ considerably in subject matter and genre as well as in quality. As for the individual papers, it is difficult — and hardly makes sense — to evaluate them. Still, following the general remarks above, some examples of successful and not so successful publications seem worth considering here.

Papers on statistical physics stand out in this context. The special attention to this section apparently reflects the personal interests of the editorial staff members as active researchers. Here one finds useful methodical notes, for example, “The relationship between the deterministic and stochastic descriptions in the general course of physics” (Vol. 4, No. 2, p. 16) and the closely related “Probabilistic models in natural sciences and humanities” (Vol. 5, No. 4, p. 103). To the same group of publications belongs “Fluctuation ideas and generalized uncertainty relations in the general course of physics” (Vol. 3, No. 4, p. 7). Notes on specific themes come along with papers of a somewhat different nature. “A new approach to the discipline ‘Concepts of modern natural sciences’” (Vol. 5, No. 4, p. 23) is a

general methodical article in which, as its abstract says, “a new approach to constructing integrated natural science courses ‘Concepts of modern natural science’ and ‘Fundamental natural science’ is offered, which considers cross-disciplinary natural science ideas as the basis for the integrated description of nature”. It is believed (see Vol. 5, No. 4, p. 85) that these courses, currently being offered at all the universities, might fill a niche in the shaping of students’ world outlook — a niche which the demise of the Marxist-Leninist philosophy has ravaged. Among the basic concepts indicated are ‘The concept of secondary probability’ (classical physics), ‘The concept of primary probability’ (nonclassical physics), ‘The concept of fluctuation and the pair correlation of conjugate physical characteristics’, ‘The concept of reversible dynamics of object characteristics’, and ‘The concept of reversible dynamics of states’. Broad generalizations are made in the paper “Improving the general physics course” (Vol. 3, No. 4, p. 147). In the author’s view, “a new revolution took place in physics and in natural sciences as a whole”, which “has advanced the dynamics of complex systems involving probabilistic aspects of transitions through unstable states and has highlighted the concepts of bifurcations and dynamic chaos... These advances in the physics of the mid-twentieth century lead to a totally new, probabilistic picture of the world”. Based on this view, a physics course program is proposed in which quite general issues including problems related to the earth’s self-organization, biosphere, power engineering, ecology, and the formation of social consciousness are embraced.

Specific ideas on how to teach the course ‘Concepts of modern natural science’ are discussed, among many other papers, in “Some humanitarian aspects of the advances in modern physics and their reflection in the ‘Concepts of modern natural science’ course” (Vol. 5, No. 4, p. 93) and “Educational and methodical resources and the teaching technology for the ‘Concepts of modern natural science’ course at the university Departments of Arts” (Vol. 5 No. 4, p. 99). The last-named paper suggests conducting a practical class session for determining the difference between science and pseudoscience using astronomy and astrology as examples. “Small-scale experimental test assignments graphically illustrate that the verification and falsification principles are not applicable to astrology, revealing the pseudoscientific nature of astrologic postulates and predictions.” It is regrettable that a regular method of unmasking a pseudoscience is not described in detail by the authors.

Given the declared struggle against pseudoscience within this course, one is quite surprised to run into statements like “it is necessary to employ a unified system of cognition which includes the knowledge of God, the world, and man” or “as cognitive systems, the basic ones — theological, philosophical, and natural-scientific — should be represented” (Vol. 5, No. 4, p. 115). Clearly, “there is no denying that religion has always played a key role in shaping the world outlook of people” (Vol. 5, No. 4, p. 89). But not of all people, one should only add, and not religion alone. For some, world outlook is strongly affected by, for example, chiromancy — and for some, by the same astrology. But this is not enough reason for spreading rubbish in the student community. Just imagine students forced to master theology and be examined in their profound knowledge of God!

Reasonable ideas about the optimization of a physics course in modern conditions are suggested in the paper “Issues of modern education: physics knowledge in terms of

demandness and perception by students of nonphysical specialties" (Vol. 5, No. 4, p. 57). The paper discusses the following observation by M Planck: "The public is always impressed with a curriculum plan including the modern issues of scientific research. But such a practice is extremely dangerous in that a solid treatment [of the issues] is out of the question here; this can make students intellectually superficial and conceited of their knowledge". As for the relationship between the 'informational' (fact-finding) teaching and 'fundamental' teaching (one allowing a person to work creatively, to solve nonstandard problems, and generate new knowledge), there is a great division of opinion among the journal contributors. It would therefore be very useful to discuss this issue on the journal's pages. A further, if more specific problem which deserves discussion is: If a backward and poorly prepared student enters a university, is the university supposed to complete his or her school physics course? Two neighboring papers (Vol. 5, No. 4, pp. 50, 57) take different views on this point. One may extend a list of debatable issues which have been only mentioned but not worked out in sufficient depth on the pages of the journal.

Important ideas are put forward in the paper "How much physics does a technical college student need?" (Vol. 7, No. 1, p. 5). It is difficult to disagree with the author's statement that "in technical colleges and universities most students are in fact faced with the profanation of physics rather than with physics itself". The level of many papers on teaching physics in technical colleges serves as indirect evidence in favor of this view. In the author's opinion, "physics is a good training device for a technically oriented mind" and, speaking of "the policy of a state taking care of its technological progress, it is extremely important to select clever and intelligent engineers even when they are still students... In a physics course which is reduced to a minimum and adapted as close as possible to specific applied problems, the world outlook dimension disappears completely. The scientific perception of the surrounding world... loses its priority nature. Hence preconditions for anti-scientific utopias, for mysticism and charlatanry".

Among methodical notes some are quite serious in content (e.g., "Lobachevsky's geometry and Einstein's kinematics", Vol. 6, No. 3, p. 5) and some are notable for a thorough methodical treatment of the problem under study ("Inertial forces in a general physics course", Vol. 6, No. 2, p. 5), but occasionally all but trivial issues are also discussed (for example, "Fundamental theories of matter and interaction. Introduction to a discipline", Vol. 6, No. 3, p. 30, or "Methodology for the study of forced vibrations in the general physics course at the pedagogical institutes, Vol. 7, No. 4, p. 63). In one and the same issue (Vol. 6, No. 3), together with an interesting note "Nontraditional effects of the electrostatic interaction of charged conducting balls" (p. 49), a formally related note "Gravitational interaction of spherical bodies placed in an infinite medium" (p. 63) is published. The author of the latter work "proposes a hypothesis according to which the equation for the gravitational force between two spherical bodies in an infinite medium" is written as that for points whose masses are the differences between the masses of the balls and those of the medium 'displaced' from the volume of the balls. This "equation can be experimentally verified using the Cavendish balance... The aim of the offered experiment is to confirm the hypothesis that the gravitational force between two bodies depends on the density of the medium which encloses the bodies".

Some of the journal's papers published have no relevance to teaching physics. Examples are "Foundations of the theory of natural processes" (Vol. 6, No. 3, p. 111) describing a class session on geochemical cycles, and "Stationary states of open systems and the rational exploitation of bioresources" (Vol. 7, No. 1, p. 123), with a fish catch strategy study attempting to determine "how the greatest possible quantity of fish of a given species may be caught without damaging the commercial stock".

A number of papers are published in English. Perhaps the interesting paper by Japanese authors, "University physics education in Japan during the recent reform period: Tokyo University exemplified" (Vol. 3, No. 4, p. 19) would be accessible to a broader audience if translated into Russian. On the other hand, it is totally impossible to see the point of publishing the authors from Kabardino-Balkaria in English (Vol. 7, No. 1, p. 91; Vol. 7, No. 4, p. 77).

Much of the journal's space is devoted to normative documents, for example, 'State Educational Standard for Higher Professional Education' and 'State Requirements to the Program Content Minimum and the Preparation Level of Graduates in Specialty 010400 — Physics' (Vol. 2, No. 4, p. 125).

Perhaps the journal's most valuable contribution to physics education is its numerous notes concerned with new methods in teaching difficult aspects of physics and information about new physics laboratory practical works.

The high scientific and pedagogical expertise of the journal's editorial board members clearly ensures further growth of the journal and promises exciting methodical findings and more and more good physics. The proportion of shallow, formal and boring articles is, as already noted, decreasing in time — contributing to the journal's popularity and enhancing its reputation.

One may wish editorial staff members (responsible for putting out different issues of the journal) more continuity and more stylistic uniformity and coordination. As indicated above, the periodical would benefit greatly from including discussions on the issues currently bothering the scientific community and faculty. In particular, the educational reform has been repeatedly addressed by prominent scholars and teachers in their mass media statements; indeed, a collection of articles titled *Education Which We May Lose* has been published jointly by Moscow State University and the Institute of Computer Studies in 2002.

However, this thorny problem has not yet been discussed on the pages of *Physics in Higher Education*. We also note that a 'Letters from readers' section might profitably be added to the journal, as might a section featuring abstracts of printed somewhere else or on-line papers devoted to physics teaching in higher educational establishments.

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