Problem Definition

Assessment of achievement at school has always been the central issue for education experts. Over the last few decades, interest in the matter has further increased due to regular international benchmarking studies such as the Program for International Student Assessment (PISA), the Progress in International Reading Literacy Study (PIRLS), and the Trends in International Mathematics and Science Study (TIMSS).

The aforementioned international studies perform two very important functions:
1. Promoting the establishment of a basic system of educational targets; and
2. Creating a strong policy incentive for education quality improvement in the participating countries.

However, to structure an efficient national school education system it is necessary not only to know the key priorities and targets but also to include them in practical work done by schools and teachers as they directly affect teaching quality improvement. In other words, regions and schools should have a pedagogical feedback instrument which would give educational counselors and teachers a simple and clear picture of modern educational targets as related to the learning process, and help them understand existing deficiencies. It is the task of bringing the modern system of pedagogical dimensions closer to teaching practices that the team of Russian experts is trying to address by developing an instrument – Monitoring Achievements of School Students (MASS) – to assess academic and subject-specific competences of primary school pupils.

Instrument Description

Development of instruments to monitor pupil’s academic and subject-specific competences in primary school is based on the achievements of Russian pedagogical psychology associated with the Vygotsky School. The instrument is based on educational process interpretation as ‘cultural development’. Proceeding from available research in that area, the designers focused on the acquisition of cultural cognitive tools as the key content of school education. Such tools are treated as generalized mental action techniques reflected in various symbolic structures (language, schemes, symbols, texts, etc.).

Three key points have been identified in the cognitive tool acquisition process, each of them being linked to a certain type of intellectual innovation. These types of innovation are accepted as criteria of three major literacy levels. Within the system under consideration, a level means the
type of cultural tool (fragment of the academic program content) acquisition by the child, with the resulting opportunities for thinking and action (Fig. 1).

Level 1 (*reproduction*) – reliance on the form of the cultural model of action.

A general criterion of achievement at this level is action according to a formal model which assumes the ability to identify a problem situation by external attributes and use the relevant action algorithm (rule).

Level 2 (*reflection*) – reliance on the substantive basis of the mode of action – a notion focusing on the substantive aspect of the given subject area.

Level 2 indicator: doing assignments where external characteristics of the situation described do not guide action while the substantive aspect is disguised/noised by extraneous details or the structure of conditions.

Level 3 (*production*) – orientation to the field of opportunities as related to the mode of action.

Assignments at this level assume actualization of the ‘functional field’ which provides for a flexible attitude towards the assimilated mode of action and a possibility to address the issue using other intellectual resources.
The third level of the mode of action corresponds to the pedagogical notion of competence, and the proposed approach as a whole may be considered as an attempt to construct competence diagnostics using a psychological foundation.

The instruments under development are oriented to assessing a few types of ‘literacy’\(^1\) in primary school, as related to the assimilation of the action-based content of major academic disciplines.

*Reading literacy* is the ability to understand and reflect on written texts and use their content to achieve one’s own objectives, develop knowledge and expand opportunities.

*Mathematical literacy* is the ability to establish and understand the role of mathematics, make mathematical judgments and use mathematics to solve practical and cognitive problems.

*Scientific literacy* is the ability to perceive scientific information, make conclusions on the basis of observations and experiments, and solve practical problems associated with natural features and phenomena.

*Linguistic literacy* is the ability to operate various language units (sounds, words, sentences), characterize them, and use them to construct various texts.

*Academic literacy* is the ability to 1) draw the line between knowledge and ignorance, and 2) make a request for missing information.

Texts for each material fragment of the academic content shall be developed together with problems corresponding to levels 1, 2 and 3. An example of a three-level mathematical literacy problem to measure the area of a figure is given below.

**Level 1**

How many square centimeters are there in the area of rectangle \(ABCD\)?

\[
\begin{array}{c}
A & \quad B & \quad C & \quad D \\
\hline
& & & 1 \text{ cm}^2
\end{array}
\]

Answer: ________________

\[
\begin{array}{c}
A & \quad B & \quad C & \quad D \\
\hline
& & & 1 \text{ cm}^2
\end{array}
\]

\(^1\) The term ‘literacy’ is widely used as a synonym of the term ‘competence’ to denote functional proficiency in certain tools and techniques.
**Comment:** This assignment may be done by placing the unit area (the small square) directly into the figure to be measured.

**Level 2**

Measure the area of the figure shown in Fig. 1 using the shaded figure shown in Fig.2 as a unit area. Write down the resulting number.

![Fig. 1 and Fig. 2](image)

**Answer:** _______________

**Comment:** Unlike level 1 assignments, ‘direct’ placement is not applicable in this case; the unit area shall be first transformed into a figure of a similar shape (a strip) or the pupil shall start operating numbers instead of figures (the unit area is equal to 5 cells).

**Level 3**

Measure the area of the big triangle using the small triangle as a unit area. Write down the resulting number.

![Fig. 1 and Fig. 2](image)

**Answer:** _______________

**Comment:** Direct placement of the unit area (level 1) is impossible. Redoing both the figure to be measured and the unit area (level 2) is quite difficult. In fact, it is necessary to ‘invent’ a new technique: to complete both figures shaping them into rectangles. In doing that, the pupil must
understand that a simultaneous increase of the amount to be measured and the measuring unit by the same factor does not change the result.

Calculation of the percentage of solved problems (separately for each level) would allow constructing a profile of each pupil, class or several parallel classes for each tested discipline (Fig.2).

![Graph showing percentage of solved problems](image)

**Fig. 2. Mathematical attainment profiles of two pupils**

The difference between the profiles shows that one of the pupils is lagging behind in understanding which, in its turn, affects the functional proficiency.

As to monitoring instruments, it is a set of five subject-specific text packages, each of them including:
- A technological matrix which is a system of means/modes of action whose assimilation shall be tested within the framework of a given academic discipline;
- A bank of problems that makes it possible to create equivalent test versions; and
- A key and form for primary registration and processing of test results.

The set has four questionnaires attached to it with a view to collecting additional data on learning conditions and educational process characteristics by surveying children, teachers, parents and school administrators.

*The questionnaire for pupils* consists of a few parts with questions on: the pupil and his/her family; the pupil’s attitude towards the education institution, learning and teaching; specific subjects (mathematics, Russian language, reading aloud, and science); use of computers; time required to do homework; assistance received by the pupil during the learning process; self-
assessment and self-monitoring (self-assessment of his/her own academic capacity and knowledge level); and teaching/learning resources.

*The questionnaire for parents* is oriented to questions on: time spent by the parents on the child’s homework; availability of complete/incomplete information on the learning process from the child; the child’s condition after school (tiredness, irritability, etc.); ideology and technology of learning process organization at school; parents’ involvement in school life; and assessment of work done by the school teachers and administrators.

*The questionnaire for school administrators* includes questions on: the institution’s resources; teaching/learning process; specific features of the institution’s education system; subject-specific teaching peculiarities; relations between pupils, teachers and administrators; and methods and forms of internal school management.

*The questionnaire for teachers* covers the following aspects: time spent on preparation for lessons; availability and quality of operating instructional programs; organizational forms of the teaching process (their number per unit time); use and performance of modern education technologies; time required to study the subject in different forms and places; and professional development.

**Intermediate Results of Monitoring Instrument Development**

Development of instruments to monitor pupils’ academic and subject-specific competences in primary school started in 2006 with the assistance of the World Bank.

The two-year effort made it possible:

- To review international and national approaches to assessing pupils’ educational achievement;
- To elaborate a concept of monitoring academic and subject-specific competences of primary school pupils;
- To develop model problems with a view to assessing reading (fiction and information texts), mathematical, scientific, linguistic and academic literacy and pilot the problems in education institutions in 10 regions of the Russian Federation, with the overall coverage of about 1,500 primary school pupils; and
Since 2008 the instruments have been under development with the support of the Center for International Cooperation in Education Development.

Over that period, it has been possible:

- To prepare a large number of diagnostic problems to assess reading (fiction and information texts), mathematical, scientific, linguistic and academic literacy of primary school graduates;
- To develop questionnaires to survey educational process participants;
- To pilot the diagnostic materials; and

At present:

- International experts are completing the review of the instruments to determine how they may be further developed and disseminated in FTI and other developing countries; and
- A review is under way to compare the conceptual basis of the proposed monitoring instruments with modern approaches to assessing academic achievement used in international practice.

It is expected that the development of the monitoring instruments would make it possible:

- To create a “construction kit” (technological matrices and criteria) to design test assignments for teachers and educational counselors;
- To expand the bank of problems for assessing academic and subject-specific competences, with the statistical check of their validity;
- To design a computerized pupil testing system based on the developed materials;
- To prepare recommendations for education authorities and teachers on how to use monitoring outcomes in teaching practice; and
- To pilot the instruments on a large scale.

**Potential Users**

Monitoring of academic and subject-specific competences of primary school pupils is mainly oriented to schools which need diagnostic tools not only to assess the educational outcomes but also to support the learning process at its major stages by providing feedback to pupils, parents and teachers.
Testing results may be used to assess both individual pupil attainment and group-level achievement. The opportunities provided by the instruments, in their turn, enable teachers to give an objective assessment to the results of their work, understand its merits and demerits, and improve and develop their teaching practice based on the feedback.

Monitoring data may also have practical significance for education authorities, educational counselors, those who specialize in education quality assessment, as well as teachers of pedagogical colleges, universities and additional vocational education institutions.