Argos Observation System. Computer Program Enhancing Observation of Classroom Proceedings in Primary School

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Introduction

Among factors that determine students' achievements, the school environment plays a key role. Interactions between students and teachers, communication in a peer group, educational and didactic methods all constitute what might be called a classroom climate, which is fundamental for school effectiveness analyses [4, 6, 9]. Interactions between students and teachers represent an important mechanism for the development of children's self-regulatory abilities, influencing significantly their involvement in the learning process [12]. The previous research points to three domains of classroom interactions that are crucial for children's academic achievements: classroom management, classroom climate, and number and type of instruction observed in the classroom [2, 8, 10, 11]. Student outcomes has been found to be related to teachers' instructional strategies, i.e., clarity of rules, management of students' behavior, time, and attention [5]. Classroom climate, (i.e., a positive and warm teacher–child relationship characterized by the teacher's regard for children's perspectives and responsiveness to their needs and interests) promotes development of academic skills [1, 3]. The same applied to high quality of instruction (i.e., active monitoring and scaffolding of children's learning and thinking, and tailoring the intruction) [3,7,8,9].

The analysis of the processes occurring in the classroom results in the large amount of information, help to construct programs dedicated for teachers and educators. The observational method is very frequently used in the analysis of the classroom atmosphere.

The need for observational data

Educational Research Institute conducts the Longitudinal School Effectiveness Study. The aim of the study is to identify the key school factors determining the academic achievement of students in Poland. Among many measurements planned during the study, aimed at describing individual, family and school characteristics, the observational study was designed to gather the very needed data on teachers' practices and classroom environment. The research team faced two circumstances that pushed it toward the construction of the computer application for classroom observation, Argos. The first one was the need for reliable description of the typical language (Polish) and maths lessons in large sub-sample of classrooms participating in the study. The second one was the lack of observational tools on Polish market that would not require the presence of a camera during observation. The basis of the theoretical concept used for the observational study and Argos observation system were two acclaimed systems for classroom observation. The systems CLASS (The Classroom Assessment Scoring System) and inCLASS (Individualized Classroom Assessment Scoring System) were created by the team of specialists from the Virginia University, under the supervision of professor Robert C. Pianta.

There were two stages of the observational study, conducted by Educational Research Institute. The first was to collect data that would allow for the examination of the psychometric properties of the Argos observation system. The second was to describe class climate in a selected sub-sample of fifth-grade classrooms participating in the Longitudinal School Effectiveness Study. The observations were conducted from March to June 2013. First, the

pilot study was conducted. During this study, 37 observers performed 8 hours of observations in twenty third-grade classrooms, followed by 10 hours of observation in twenty fifth-grade classrooms in the same schools (5 hours during Polish lessons, 5 hours during Math lessons). The main observation study was conducted in 69 fifth-grade classrooms participating in the Longitudinal School Effectiveness Study. 43 observers performed 15 hours of observation in each classroom (8 hours during Polish lessons and 7 hours during Math lessons).

Reliability analysis

For reliability testing of Argos observational system two research designs were used. First one consisted of a number of observational sessions, where all observers participating in a study were asked to code simultaneously the same set of video-recorded lessons, which were coded earlier by the group of experts. The second one employed the double-coded observations (i.e. pair of the observers coded the same lesson in the same mode) in the field during the pilot study. The data were later analyzed with the use of Signal Detection Theory (SDT) and The Receiver Operating Characteristic (ROC) method, which allowed for estimation of sensitivity and specificity of each observer, using dedicated computer application with graphical user interface created in R environment.

Argos as a computer application

Argos is an application developed for Windows operating system. Graphical user interface consists of Main Window and the multiple Tool Windows, situated next to the Main Window. The Tool Windows can be embedded within the Main Window. Most procedures in the application are executed by drag & drop operations, within one Tool Window or between two such windows. The application Argos enables observers to use keyboard shortcuts and the console as well.

The Argos application uses the collections of .xml files, called templates or projects, that specify what is being observed. The modular structure of projects allows easy adaptation of existing templates to suit the researcher needs as well as creating entirely new ones. The following sections describe the projects developed for classroom observation, a part of Longitudinal School Effectiveness Study.

The Argos application works in one of two modes. The first one is a configuration mode, where the observer prepares his working environment. In this mode, observer creates a new project or opens the one prepared earlier and according to the situation of particular class – defines the project elements (e.g. creates students list, defines seating arrangement of students). The classroom is represented in the Classroom Map window as a square grid. Each square can correspond to only one person, represented by circle with a personal identifier inside. Once the observer defines all the necessary project elements, he is allowed to activate the Observation mode.

The Argos observation system

The Argos observation is a very flexible system, which – at this moment – enables classroom observation using three templates: observation focused on a teacher, observation focused on a student and didactic (instructional) observation.

In each of these projects observer registers students' or teachers' activities during lesson by marks events or threads in the rows of Course of the lesson window. Event has a temporary character, e.g. individual behavior or gesture. The application automatically remembers the time for every event. It is possible to define an initiator and the recipient for an event. Threads describe longer states, e.g. lesson stages. Events and threads can have attributes, e.g. teacher work form described for particular lesson stage. In teacher- and student-focused observation the time-sampling methodology was applied, supported by the functionality called the Counter.

During 25 (teacher-focused observation) and 24 (student-focused observation) time samples, the observer registers specific behaviors (from the pre-defined list of observed behaviors) of a teacher or students and records them on the time axis in one of the application windows. A single time sample lasts 1.5 minutes – during 30 seconds the observer is observing a teacher or a student, and during the subsequent 60 seconds he or she marks the observed behavior on the time axis. The Counter automates the whole sampling process, enabling the observers to focus only on students' or teacher's behavior.

The main Counter's task is to countdown the time within the time samples and separating the observation and registration stages. After the time sample dedicated for observing one students ends, the Counter automatically highlights the next one on the Classroom map, helping the observer to follow the student sampling design. Additionally, in order to separate observations of particular students, the Counter automatically switches the active row in the Course of the lesson window. The data from the observation are saved as an xml file.

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