



SUBJECTIVE ASSESSMENT OF CLASSROOMS AT THE FACULTY OF CIVIL ENGINEERING - PRELIMINARY STUDY

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ABSTRACT

Acoustical conditions in classrooms can be evaluated in many different ways and several objective and subjective acoustical methods already exist. In this paper we aim on the development of the questionnaire for the subjective assessments of rooms that take into account also other than acoustic aspects. In the performed research, also a type of a lesson is given, the age and the gender of the responded are noted and a preference of a teacher, i.e. if he or she likes to give that particular lesson is followed too. The article contains both qualitative and quantitative answers, showing results from a preliminary study that concern acoustic quality in twenty-six (26) classrooms at the Faculty of Civil Engineering at STU Bratislava. Fifteen (15) teachers who give lessons in the selected classrooms have participated in the survey, by answering five (5) questions.

INTRODUCTION

Human assessment usually uses a multisensory mechanism and it is typically based on the analysis of the information, gained from multisensory perception, such as audiovisual or audio haptic etc. In a global assessment of classrooms different factors such as visual, acoustic and thermal comfort, ventilation, hygiene etc. play role [1-7]. In research studies that related to subjective assessment, it is therefore difficult to discriminate and to follow only one chosen feature. It is well known, that educational outcome is strongly influenced by acoustical comfort in classrooms at every level of education and that learning process is very sensitive to interaction between teacher and students where speech intelligibility plays a significant role [8-10]. Speech intelligibility depends on reverberation time that can be influenced by treatment of the classrooms by sound absorption on one hand and also on signal-to-noise ratio on the other hand [11]. Signal to noise levels in a classroom depend on background noise level that is strongly influenced by sound insulation of a façade, doors, and surrounding structures and also by reverberation itself [12]. It has been also reported, that long reverberation time causes higher activity noise levels so, that teachers need to raise their voice, due to so called Lombard effect [13].

It has to be noted, that once a school is built in a noisy city area, and faced insulation is sufficient, background noise levels might be high anyway, due to natural ventilation, i.e. opened windows to noise street. In the literature lot of information can be found on objective assessment and acoustic measurements in schools, mainly in terms of monitoring and proposing an optimal reverberation time and speech intelligibility [14-16]. Subjective assessment of teachers refers not only to understanding of speech, but also to voice efforts [17]. Some authors reported that most of the teachers have or had vocal problems due to bad acoustic conditions at least once during their lifetime and that voice problems influence the teaching [18, 19].

DESCRIPTION OF THE EXPERIMENT

Twenty-six classrooms have been chosen for this study. Figures 1-3 shows their position in a ground floor plan of the Faculty building in relation to noisy street. In the Table 1, list of evaluates classrooms is given together with its volume and for known rooms also measured reverberation time at the frequency of 1 kHz is given.

Table 1. Evaluated classrooms and their volume and measured reverberation time at the frequency of 1 kHz
some of the classrooms

Classroom	Volume (m ³)	Reverberation time (s)	Classroom	Volume (m ³)	Reverberation time (s)
BAT	2486		B213	132	1.19
B101	6533	1.40	B214	359	
B103	829		B215	140	
B105	634		B217	266	1.80
B106	649		B219	260	
B108	819		B310	190	
B112	197		B312	186	
B207	258		B316	1238	
B208	148	1.60	B318	225	
B209	259		B319	1236	
B210	145		B320	228	
B211	267	1.95	PU 01	140	
B212	227		15/18	80	

Eighteen university teachers from the Department of Building structures (KKPS) have been interviewed. Two colleagues refused to answer questions and another one reported, that she concentrates on students, rather than on classrooms :-). Finally fifteen persons in the age between 28 – 60 (6 female and 9 male) have filled in questionnaire. Each respondent has answered five (5) following questions: (Q1) in which classrooms have you taught last year, (Q2) indicate classrooms in which you like to give lessons, (Q3) indicate classrooms which you don't like, (Q4) which lessons, regardless classroom itself, you like and which you don't like to teach and (Q5) which room(s) would you indicate as acoustically worst.

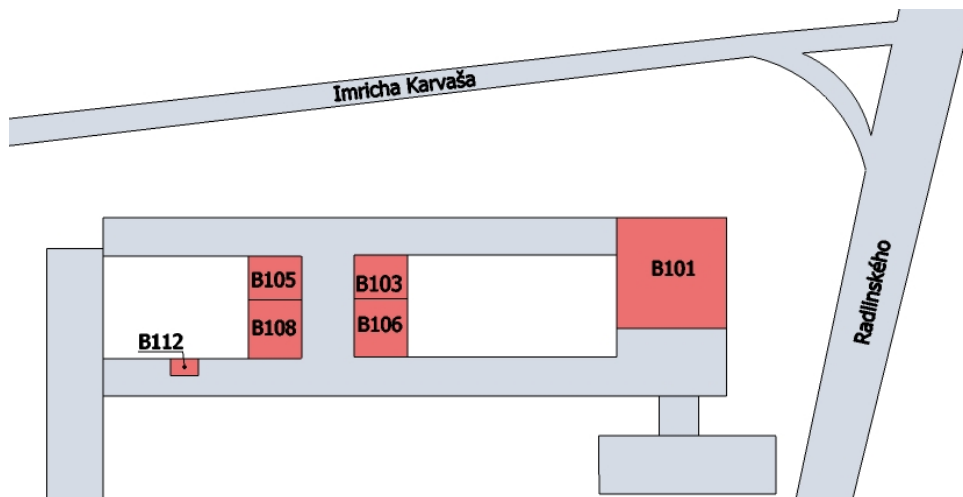


Figure 1. Position of classrooms on the 1st floor in block B

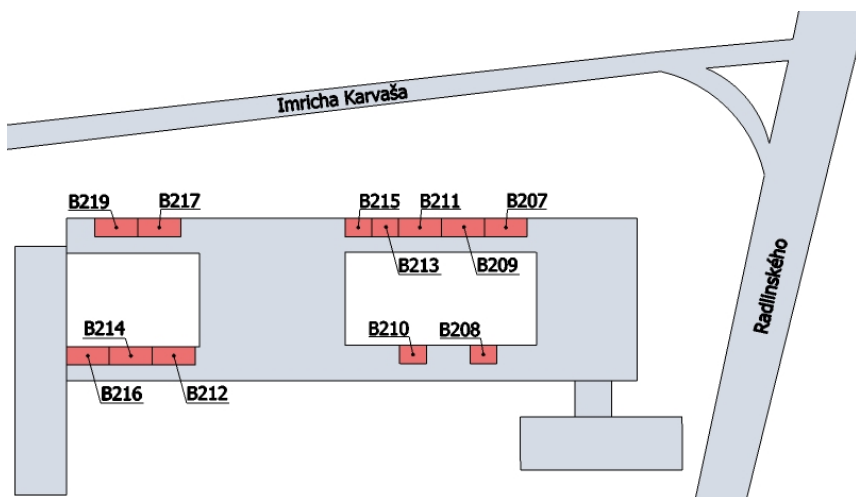


Figure 2. Position of classrooms on the 2nd floor in block B

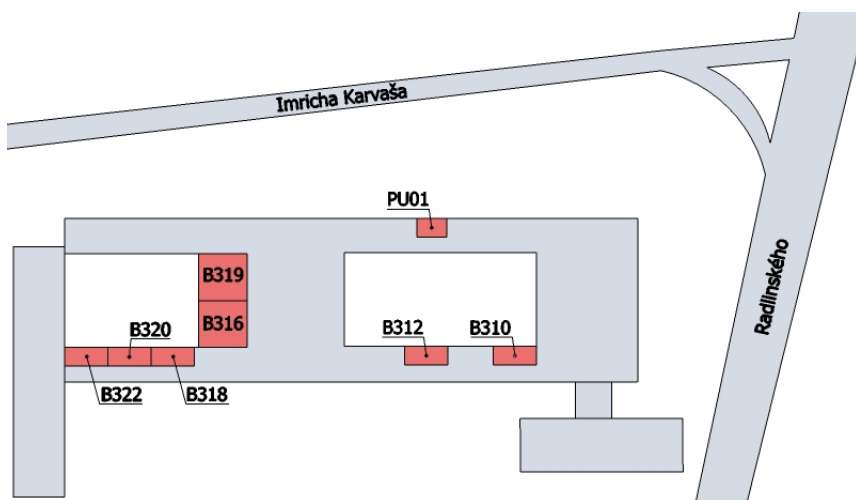


Figure 3. Position of classrooms on the 3rd floor in block B

RESULTS AND ANALYSIS

Most used classroom, i.e. a room where most of the interviewed teachers from KKPS teach is classroom called “BAT”. Here, eleven (11) out of fifteen (15) persons gave lessons last year. This room is large room, with a volume of 2486 m³ and it is used for so called “atelier” or “design studio”. Here, typically many students and teachers gather at the same time and discuss about projects in groups. In this way, many sound sources are present in the room at the same time. This room has been renovated and it is treated by sound absorbing wall panels that reduce reverberation time and noise levels in its interior. If we look at the summary of all answers (Figure 4) we can see, that more than half of the teachers indicated this place as pleasant to teach and only two (2) of them listed this room as place, which they don’t like, mainly because of lack of ventilation (fresh air). Nobody has indicated this room as acoustically worst.

On the other hand, when comparing results with a question Q4, about preference of lessons, the “design studio” (which is taught here) has been listed as one of the favorite lessons of all asked teachers. This might have influenced the objective assessment of this classroom. More detailed investigation is therefore necessary.

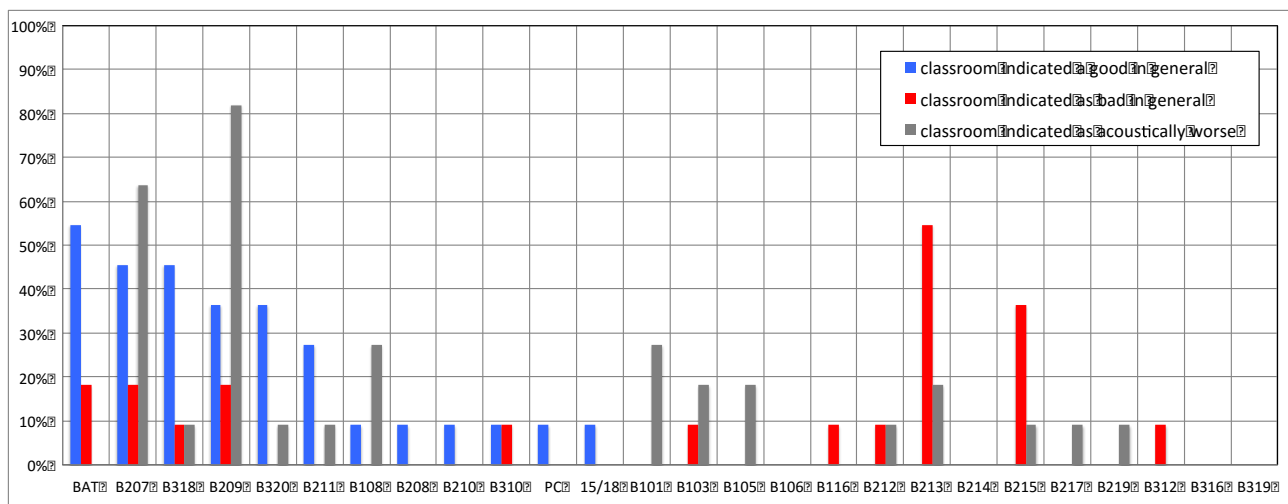


Figure 4. Summary from all answers

If we look at the rooms from a point of view of question Q2 we can conclude, that beside the room “BAT”, more than 40% of people liked classrooms B207 and B318. Classrooms B209, B320 and B211 have been also indicated by around 30% of people as “good” in general. Interestingly, B207 belongs also to room indicated by more than 60% of people as a room with bad acoustics and B209 has been pointed out, by more than 80% of people as acoustically worst. More investigation is therefore necessary, in terms of “why” teachers who indicated these rooms as good like them. Another observation shows, that persons, who don’t like the room “BAT” liked the acoustically worst rooms (uneven numbers) best.

Classrooms that have been chosen by teachers as “bad” in general are rooms B213 and B215. Mainly because of the fact that these rooms are too small for ca. 22 students what is usually an average number of students in one group. These classrooms were originally intended for groups of ca 14 students. Some teachers explained that the blackboard is also too small.

Interesting observation is that three (3) people have indicated aula (B101) as acoustically worst, however non of them have been teaching there last academic year. Reason given by respondents is, that teachers need microphone-loudspeaker system to give lesson and they don’t like it.

Finally, if we look at the lessons which are liked and not liked, we can conclude, that most liked is design studio (atelier). Building constructions (KPS) like half of the people and second half don’t like to teach it.

Pathology of buildings has been assigned as a lesson which is less preferred among asked people.

We can conclude that in general, teachers at KKPS like to teach their lessons very much.

CONCLUSIONS

Results from quantitative study are summarized in the Figure 4. However, these numbers cannot be considered as final and they serve in this preliminary study only as an indication. If we look at the results from qualitative point of view, we can see that observations based on verbal description and free comments of teachers can be summarized as follows. Most liked room is room BAT, where teachers also give lesson that they like mostly to teach and where teaching is not “frontal” but in groups. In this way, teachers don't need to raise their voice, as the source-receiver (Teacher-student) distance is short. Teachers prefer to teach in rooms where microphone is not necessary, but they don't like too small rooms. Classroom volume has turned out to be an important factor. All classrooms with uneven numbers, i.e. with windows oriented to noisy street are not comfortable because of noise and also because of distraction of students who look out of the window when they hear some sound. Windows need to be renovated or replaced in order to reduce the high background noise levels. Small rooms oriented to noisy street are even worst because of noise from internal source and small blackboards. Rooms toward atrium are preferred. They are quieter and also closer to elevators and offices. Classroom 15/18 is difficult to be ventilated due to noise from trams, which is in all classrooms in the C block significant.

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