



**Interactive Music Science Collaborative Activities
Team Teaching for STEAM Education**

Deliverable 5.17

Final Version of Usability validation of iMuSciCA toolkits

Date:	21/06/2019
Author(s):	Maximos Kaliakatsos-Papakostas (ATHENA), Thomas Fischer (EA), Petros Stergiopoulos (EA), Fotini Simistira (UNIFRI), Vassilis Katsouros (ATHENA)
Contributor(s):	
Quality Assuror(s):	Daniel Martín-Albo (WIRIS), Jeroen Op den Kelder (UCLL)
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Executive Summary

This deliverable reports on the usability validation of the final iMuSciCA workbench version as an integrated tool. Usability testing has been performed on teachers and students during the Phase B of the pilot testing in schools in Greece, France and Belgium and incorporated the development of educational scenarios (for teachers) and execution of specific tasks by students. Responses in questionnaires were collected that evaluated the overall educational approach offered by iMuSciCA; this deliverable focuses on answers by teachers and students that indicate the integrity of the entire workbench in terms of usability and user experience. According to the responses, specific directions have been summarised for improving specific aspects of some Activity Environments. Positive feedback was generally provided, indicating that the final version of the workbench is an overall reliable, easy to learn environment.

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TABLE OF CONTENTS

Executive Summary	1
1. Introduction	5
2. Methodology	5
3. Results	5
3.1 Teachers' results	5
3.2 Students' results	6

LIST OF ABBREVIATIONS

Abbreviation	Description
STEAM	Science, Technology, Engineering, Art, Mathematics
3D	3-dimensional
AE	Activity Environment
DrawME	Drawing Canvas Activity Environment
UI	User Interface
UX	User Experience
GSR	Galvanic Skin Response
EEG	Electroencephalography
WP	Work Package
ATHENA	ATHENA RESEARCH AND INNOVATION CENTER IN INFORMATION COMMUNICATION & KNOWLEDGE TECHNOLOGIES
UCLL	UC LIMBURG
EA	ELLINOGERMANIKI AGOGI SCHOLI PANAGEA SAVVA AE
IRCAM	INSTITUT DE RECHERCHE ET DE COORDINATION ACOUSTIQUE MUSIQUE
LEOPOLY	3D FOR ALL SZAMITASTECHNIKAI FEJLESZTO KFT
CABRI	Cabrilog SAS
WIRIS	MATHS FOR MORE SL
UNIFRI	UNIVERSITE DE FRIBOURG

1. Introduction

The aim of this deliverable is to provide broad insights about the usability and user experience of the iMuSciCA workbench as an integrated learning environment. The final usability validation tests were carried out during Phase B testing and included answers from teachers and students to questionnaires as well as basic discourse analysis from free-form interviews. While the first usability validation tests that have been reported in Deliverable 5.6 provided specific directions for each activity environment (AE) and tool, this Deliverable incorporates overall information about the workbench, with some specific descriptions about how some user remarks have been addressed in the final version.

2. Methodology

During Phase B testing in Belgium, Greece and France, teachers and students were given some basic instructions on what the iMuSciCA workbench is and how some basic functionalities work. Afterwards, teachers were asked to come up with educational scenarios that incorporated the use of the workbench and answer a questionnaire. In what concerns this deliverable, among other tasks during Phase B testing, students were given some specific tasks that involved using the workbench and were afterwards asked to answer a questionnaire. Details about how data were collected and exactly what data were obtained can be found in Deliverables 6.3 and 6.4; those deliverables analyse the experimental processes followed to evaluate the educational STEAM approach offered by iMuSciCA overall (not solely in terms of the workbench, which is the focus of the deliverable at hand).

3. Results

The results reported herein incorporate a compilation of answers that are relevant to usability and user experience of the workbench from Phase B testing. Answers of teachers and students are provided separately.

3.1. Teachers' results

Table 3.1.1 shows the summary of answers provided by 15 teachers. In the questionnaire that was handed to them, teachers had to answer to questions using numbers on a Likert scale. Average (AV), standard deviation (SD) and minimum/maximum values of the scale in each question are given in the table as well. Additionally, the "direction" of each answering scale is given, i.e., whether higher values indicate positive or negative feedback.

Table 3.1.1. Answers to questionnaires given by teachers.

		Direction	AV	SD	MIN	MAX
Q1	I think that I would like to use this system	Positive	2.80	0.90	1	4

	frequently.					
Q2	I found the system unnecessarily complex.	Negative	2.20	0.75	1	4
Q3	I thought the system was easy to use.	Positive	3.73	0.87	2	5
Q4	I think that I would need the support of a technical person to be able to use this system.	Neutral	2.67	1.30	1	5
Q5	I found the various functions in this system were well integrated.	Positive	3.87	0.51	3	5
Q6	I thought there was too much inconsistency in this system.	Negative	1.93	0.74	1	3
Q7	I would imagine that most people would learn to use this system very quickly.	Positive	4.07	0.58	1	5
Q8	I found the system very cumbersome to use.	Negative	1.73	0.72	1	3
Q9	I felt very confident using the system.	Positive	3.60	0.78	1	5
Q10	I needed to learn a lot of things before I could get going with this system.	Neutral	2.80	1.04	1	5

As a summary of the results shown in the aforementioned Table, it appears that the overall workbench experience was positive. Specifically, the system could be used by teachers for their teaching frequently (Q1), while they also found the system easy to use (Q2, Q3 and Q8).

Regarding the reflection of teachers upon a highly technical aspect of the workbench, they found the activity environments very well integrated and the overall functionality consistent (Q5 and Q6). Integration between environments was among the most technically demanding tasks that all development teams were faced with, since structural protocols had to be developed and followed for the objects in all activity environments, to allow interchange of data between them (e.g., the timbre of a string in the 3D Instrument Design environment could be broken down to separate sinusoidal elements and passed to the Tone Synthesizer environment).

While on average there was an unclear response on whether teachers themselves would need help to start using the system (Q4), strong agreement among teachers was also observed about how quickly they believed that people in general can get acquainted with using the workbench (Q7). Also, on average, it was not clear whether a teacher needs to learn a lot of new things in order to be able to use the workbench as an educational tool (Q10), even though this question is not necessarily related with the workbench as a tool/ environment rather than a medium with highly interdisciplinary content. Finally, teachers overall stated that they felt very confident in using the system (Q9) which is a good indication of overall reliability.

3.2. Students' results

Positive feedback was given by 134 students in Belgium (3 schools), France (2 schools) and Greece (3 schools) regarding the usability of the workbench as an integrated tool. Students used the workbench intensively in the context of iMuSciCA educational scenarios within the extent of several months and for total durations that ranged from 2 to 20 hours. Details about specific schools, scenarios and lesson plan durations can be found in Deliverables 6.4 and 6.3.

Students were able to carry out all their assigned tasks using the workbench, however, when asked to propose modifications for a future iMuSciCA scenario, the students suggested the following:

- *Use better sounds in DrawMe* (particularly to improve the timbre of the sounds). This suggestion has been taken under consideration and the “timbre” object will be used for employing the timbre of constructed instruments within the DrawMe environment (instead of merely synthesised sounds).
- *Add more strings in the monochord*. This comment has been taken under consideration and a 6-string virtual guitar has been added to the final version of the workbench.
- *Repair remaining bugs, related in particular to the absence of sound or to the low quality of sound*. This reported issue has two aspects: (a) absence of sound, which was due to a bug attributed to browsers freezing their audio context due to the utilisation of iFrames and (b) low quality or “laggy” sound caused mainly the object recycling in the Firefox browser. Issue (a) has been addressed and actions have been taken in activity environments that incorporate audio to deteriorate issue (b).
- *Add help on line in the workbench*: the final version of the workbench includes links to tutorials in the landing page, while each activity environment offers a link to its youtube video tutorial (within a list of video tutorials for all activity environments and tools).