

## PROJECT TITLE

Erasmus + "KA220-HED - Cooperation partnerships in higher education"

**Deadline for application:** 5<sup>th</sup> of March 2024

**Duration of the project:** 36 months, from September 2024

### **Partnership:**

University of Turin – Laboratory S. Polin (Italy)

Valle d'Aosta University (Italy)

University of Granada (Spain)

Karlsruhe Institute of Technology - ACCESS@KIT (Germany)

Masaryk University – Teriesas Centre (Czech Republic)

..... (Cyprus)

### **Objectives of the project**

The main objective of the project is to strengthen the cooperation between higher education institutions and third-sector organizations that work on the development and promotion of assistive technologies for the full inclusion of students with visual impairments in higher education to analyse, test and apply the potential of sonification processes for the representation of function graphs in teaching and learning mathematics with visually impaired students.

The project departs from the experimental digital application AudioFunctions.web, developed by the Laboratory "S.Polin". This application will be used to study and analyse the impact and potential of sonification processes in teaching and learning mathematics, as well as in relation to other existing assistive technologies, such as tactile devices. In this framework, the multi-disciplinary partnership brought together by the project will work on the following specific objectives:

**SO1:** To analyse the educational potentials and challenges of using sonification techniques for the conceptualisation of function graphs for all and as a way of providing access to this mathematical content for visually impaired people in a multimodal, embodied, and inclusive approach, and finally to develop a scientific method to test sonification methods for the representation of function graphs and the effectiveness of AudioFunctions.web.

**SO2:** To test the digital application with higher education students from different national and educational backgrounds and characteristics, to investigate the impact of cultural and cognitive factors in the access and use of the application and to improve the current version.

**SO3:** To promote and disseminate AudioFunctions.web at the European level by developing the online platform hosting the open-source application free of charge, together with a set of instructions and user support.

### **Target groups:**

The main target group of the project are visually impaired individuals, since the project intends to develop an innovative digital tool to support their inclusion in scientific disciplines. With this aim, students, scholars and experts with visually impairments will be involved in all the phases, at different levels: experts with a scientific background and experience with the current devices used in mathematics will be involved in the development and validation of the methodological protocol in the testing of AudioFunctions; University students and students approaching university will be involved in the testing of the digital tool, both regarding its usability and its educational impact; both groups will be invited in the dissemination activities and will be kept informed regarding the delivery of the platform and guidelines.

Another target group are students of mathematics in general. The educational potential of sonification processes will not be tested exclusively with visually impaired students, but also with sighted students. This because this technology has the potential to offer an innovative approach to teaching-learning mathematics for all students, and testing the tool with sighted students allows to reach a higher number of individuals.

University professor and teachers in mathematics are also a target group of the project: they will be involved in the testing activity, kept informed regarding the delivery of Audiofunctions and its use, and invited to the final conference. The same goes for CSOs working to promote the inclusion of visually impaired individuals in education.

The academic community will also benefit from the project, as one of the objectives is to enhance the scholarship on sonification processes in mathematics. Furthermore, external scholars will be invited to contribute to project activities and share their knowledge and experience.

### **Working Packages**

WP1 – Management

WP2 – State-of-the-art conceptualisation of the notion of function by people with visual impairments, on sonification processes for teaching and learning mathematics and analysis of existing tools, towards the development of a methodological framework to study and test AudioFunctions.web.

WP3 – Testing and developing phase: after updating the current version of AudioFunctions.web for testing, the application is tested following the methodological framework developed in WP2; the results of the test are used to improve the current functionalities of the application and to develop teaching and learning inclusive practices.

WP3 – Delivery of the online platform where the final version of AudioFunctions.web can be accessed together with a set of guidelines and training materials to facilitate its use. Promotion of the project results and of the application in international conferences.

## Activities

### WP 1 Management – Lead: UNITO

Monitoring Framework to be prepared at the beginning of the project;

Management Operative guidelines to be prepared at the beginning including a Quality Control Team and Advisory Board;

Financial Monitoring and administration;

Project Meetings:

1 Kick-off meeting – together with activity 2.1 (venue to be defined) - Spain

2 By December 2025 – monitoring of the activities (venue to be defined) – Czech Rep.

3 By December 2026 - monitoring of the activities (venue to be defined) - Germany

4 By September 2027 – Final meeting together with Final Conference in Turin (activity 4.4) -

### WPs implementation

W P	Activity	Start/end date	Lead Org.	Part. Orgs	Exp. result
2	2.1.State of the Art – literature review on sonification processes and analysis of existing technologies	Sept 2024 March 2025	UNITO	all	Report containing literature review and analysis of existing tools for sonification in mathematics. Academic article to be published.
	2.2 2-days meeting for developing the methodological	Sept 2024 Jan 2025	Granada	all	Road map for the development of the methodological protocol.

	protocol to test AudioFunctions				Report of the meeting.
	2.3 Development and verification of methodological protocol	Dec 2024 Sept 2025	?? Brno	All? Not Cyprus	Methodological protocol containing the interview to test the application. Report on the verification of the protocol with a restricted number of experts with visual impairments (5).
3	3.1 Development of stereophonic sonification to be included in Audiofunctions	Jan 2025 Jun 2025	Brno/Karlsruhe? Karlsruhe	UNITO, Brno, Karlsruhe	Additional feature to be included in the current version of AudioFunctions.
	3.2 Integration of features emerged during the development of the methodological protocol into the current version of AudioFunction and verification	March 2025 Sept 2025	UNITO	UNITO, Brno, Karlsruhe	Improved version of Audiofunctions ready for testing. Verification of its functionality with a restricted number of experts with visual impairments (5).
	3.3 Testing of the educational impact of AudioFunctions both with sighted and visually impaired students (50 sighted and 10 v-i)	Oct 2025 March 2026	UNI vda	UNI vda, UNITO, Granada, Cyprus	Results of the test (interview, recording) with 50 sighted students and 10 v.i.
	3.4 Analysis of the results of the testing on the educational impact of AudioFunctions	March 2026 Sept 2026	Granada	UNI vda, UNITO, Granada	Analysis of the results. Academic article to be published on the impact of sonification in teaching-learning mathematics
	3.5 Testing of the functionality and usability of Audiofunctions with a larger number of international v.i. students (50)	Oct 2025 May 2026	?? (Brno)	all	Report on the results of the testing with recommendation on how to improve the application
4	4.1 Final update of AudioFunctions following the results of the testing	June 2026 December 2026	UNITO	all	Final version of Audiofunctions
	4.2 Preparation of a series of guides on how to use audiofunctions in teaching and learning mathematics with v.i. students	Jan 2027 June 2027	?? Karlsruhe	all	Guides to be included in the online website that hosts the application

	4.3 Localisation of the platform hosting Audiofunctions and guides in all languages of the projects	Jan 2027 June 2027	?? Cyprus	all	Platform interface translated in all languages of the project (+ English)
	4.4 Final Conference – 2 days conference in Torino	March 2027 Sept 2027	UNITO	all	Conference proceedings
	4.5 Participation in 2 international conferences to present project results	March 2025 Sept 2027	?? Kralshure	all	Papers presented in conferences

<b>Full Title</b>	tion for Accessible and Inclusive Representation of GRAPHS in b
<b>Acronym</b>	SONAIRGRAPH
<b>KEY ACTION</b>	KA220-HED

<b>Budget Overview Requested</b>
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	(UNITO- COORDINATOR)	VdA	Masaryk	Granada	Karlsruhe	Romania	
<b>WP1</b>	20.700	9.800	12.200	10.900	15.800	8.300	<b>77.700</b>
<b>WP2</b>	24.400	16.450	16.100	12.600	18.500	6.100	<b>94.150</b>
<b>WP3</b>	25.440	25.200	16.740	25.500	24.720	6.600	<b>124.200</b>
<b>WP4</b>	31.550	7.600	18.900	12.600	20.700	12.600	<b>103.950</b>
<b>TOTAL</b>	<b>102.090</b>	<b>59.050</b>	<b>63.940</b>	<b>61.600</b>	<b>79.720</b>	<b>33.600</b>	<b>400.000</b>

Full Title	SONIFICATION for Accessible and Inclusive Representation of GRAPHS in Education
Acronym	SONAIRGRAPH
KEY ACTION	KA220-HED

Work Packages		UNITO (Italy)			VdA (Italy)			Masaryk (Czech Rep.)			Granada (Spain)			Karlsruhe (Germany)			... (Romania)			TOTAL
WP1 PROJECT MANAGEMENT	Unit	N. of Units	Cost per unit	TOTAL	N. of Units	Cost per unit	TOTAL	N. of Units	Cost per unit	TOTAL	N. of Units	Cost per unit	TOTAL	N. of Units	Cost per unit	TOTAL	N. of Units	Cost per unit	TOTAL	
A1.1: Organisational and administrative tasks	Days	45	240	10.800	20	240	4.800	35	180	6.300	25	180	4.500	35	240	8.400	20	110	2.200	37.000
A1.2: 2 Transnational Project management Meetings (2 interim)	Participants	4	700	2.800	2	700	1.400	2	700	1.400	4	700	2.800	2	700	1.400	4	700	2.800	12.600
A1.3: Quality Assurance, internal evaluation and impact assessment	Days	15	240	3.600	5	240	1.200	10	180	1.800	5	180	900	10	240	2.400	5	110	550	10.450
A.1.4. Communication and Dissemination	Days	10	240	2.400	5	240	1.200	10	180	1.800	10	180	1.800	10	240	2.400	20	110	2.200	11.800
A.1.5. Sustainability	Days	10	240	2.400	5	240	1.200	5	180	900	5	180	900	5	240	1.200	5	110	550	7.150
TOTAL COST WP1	Days	80		22.000	35		9.800	60		12.200	45		10.900	60		15.800	50		8.300	79.000
TOTAL REQUESTED WP1	Days			20.700			9.800			12.200			10.900			15.800			8.300	77.700
WP2 Methodological Phase - State of art and Methodological Protocol																				
A2.1.2.1.State of the Art – literature review on sonification processes and analysis of existing technologies	Days	40	240	9.600	30	240	7.200	35	180	6.300	35	180	6.300	35	240	8.400	25	110	2.750	40.550
A2.2. 2-days meeting for developing the methodological protocol to test AudioFunctions (Spain)	Participants	4	850	3.400	1	850	850	2	850	1.700	0	0	0	2	850	1.700	2	850	1.700	9.350
A2.3 Development and verification of methodological protocol	Days	35	240	8.400	35	240	8.400	45	180	8.100	35	180	6.300	35	240	8.400	15	110	1.650	41.250
SUBTOTAL WP2	Days			21.400			16.450			16.100			12.800			18.500			6.100	91.150
A2.1.a State of the art	open access for academic article	1	3.000																	3.000
TOTAL REQUESTED WP2	Days			24.400			16.450			16.100			12.600			18.500			6.100	94.150
WP3 Development and testing of AudioFunctions																				
A3.1. development of stereographic sonification to be included in AudioFunctions	Days	19	240	4.560	0	240	0	25	180	4.500	0	180	0	40	240	9.600	0	110	0	18.660
A3.2. Integration of features emerged during the development of the methodological protocol into	Days	25	240	6.000	0	240	0	23	180	4.140	0	180	0	28	240	6.720	10	110	1.100	17.960
A.3.3 Testing of the educational impact of AudioFunctions	Days	15	240	3.600	40	240	9.600	0	180	0	45	180	8.100	0	240	0	15	110	1.650	22.950
A3.4 Analysis of the results of the testing on the educational impact of AudioFunctions	Days	15	240	3.600	40	240	9.600	0	180	0	45	180	8.100	0	240	0	0	110	0	21.300
A3.5 Testing of the functionality and usability of AudioFunctions	Days	32	240	7.680	25	240	6.000	45	180	8.100	35	180	6.300	35	240	8.400	35	110	3.850	40.330
SUBTOTAL WP3	Days	106		25.440	105		25.200	93		16.740	125		22.500	103		24.720	60		6.600	121.200
A.3.4b. Analysis of testing	open access for academic article										1	3.000	3.000							3.000
TOTAL REQUESTED WP3				25.440			25.200			16.740			25.500			24.720			6.600	124.200
WP4: Delivery and dissemination																				
A.1. Final update of AudioFunctions following the results of the testing	Days	40	240	9.600	10	240	2.400	30	180	5.400	10	180	1.800	30	240	7.200	10	110	1.100	27.500
A4.2 Preparation of a series of guides on how to use audiofunctions	Days	30	240	7.200	15	240	3.600	35	180	6.300	20	180	3.600	20	240	4.800	40	110	4.400	29.900
A.4.3. Localisation of the platform testing AudioFunctions and guides in all languages of the projects	Days	25	240	6.000	0	240	0	25	180	4.500	25	180	4.500	25	240	6.000	40	110	4.400	25.400
A.4.4.a Final Conference – 2 days conference in Torino	Participants	0	0	0	2	300	600	2	850	1.700	2	850	1.700	2	850	1.700	2	850	1.700	7.400
A.4.5 Participation in 2 international conferences to present project results	Participants	1	1.000	1.000	1	1.000	1.000	1	1.000	1.000	1	1.000	1.000	1	800	1.000	1	800	1.000	6.000
SUBTOTAL WP4	Days			23.800	28		7.600	93		18.900	58		12.600	78		20.700	93		12.600	96.200
A.4.4b. Final conference in Torino	Local participants	50	80	4.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.000
A.4.4.c Fial Conference Torino	International participants	5	750	3.750	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.750
SUBTOTAL WP4b				7.750			0			0			0			0			0	7.750
TOTAL WP4				31.550			7.600			18.900			12.600			20.700			12.600	103.950
TOTAL REQUESTED WP4				31.550			7.600			18.900			12.600			20.700			12.600	103.950
TOTAL COST OF THE PROJECT				103.390			59.050			63.940			61.600			79.720			33.600	401.300
LUMP SUM TOTAL AMOUNT REQUESTED				102.890			59.050			63.940			61.600			79.720			33.600	400.000