Co-funded by the
Erasmus+ Programme
of the European Union

"AI-TOP - An AI Tool to Predict Engagement and Meltdown Events in Students with Autism"

Project Number: 2020-1-UK01-KA201-079167

AI-TOP

Output 3:

O3 - Optimisation of Autism Engagement and Meltdown Framework: Impact and Best Practices Report

Authors:
SoftQNR and NTU
Input: All Partners

Contents

1 Introduction

We should support all students with autism with opportunities to realise their potential. They should participate in education and training on the same basis as students without autism and they should not be subject to discrimination. Due to the progress in the IT sphere, digital technologies are easily accessible and widespread, and these provide students with new opportunities.

Due to the high degree of diversity among students with autism, there is no single technological solution that can suit the needs of all. The best outcomes can be achieved using custom-made solutions designed according to the requirements of a particular group of students. This is where the AI-TOP project comes in. By tracking the student's engagement and attention, it will provide guidance on pedagogical approaches that are most suitable for each individual child, based on their observed competences and abilities. It will also identify the early signs of challenging behaviour episodes, enabling early intervention to increase the chances of a calm classroom and will lead to better student mental health.

The aim of the AI-TOP project is to contribute to the uptake and implementation of inclusive education by providing teachers and teacher educators with a toolset to support engagement assessment of each child, as part of a holistic approach towards inclusive education. It also aims to raise awareness of the importance of learning technologies and provide direction for the adoption of technological innovations. The technology developed will also track students for early signs of potential rumble and meltdown moments and inform the teacher at an early enough stage for intervention. This offers support to teachers who face the challenge of teaching in inclusive education classrooms and enhances their professional development.

Tracking engagement is crucial, as deep learning is not possible without it. This project allows for the tracking of student engagement, support and re-engagement of those with the greatest learning needs, and identification of early signs of rumble moments occurring. The engagement and rumble moment prediction of the App (O2) is trained on data gathered from students with autism in schools across Europe using the project Behavioural Checklists.

In overview, the key features and aims of O3 are:

- Feedback from testing throughout the project allows optimisation of our innovative AI-Driven App (O2), Database (O1), Pedagogical Framework (O5) and Handbook (O4) to support the prediction of engagement and meltdown events in students with ASC.
- Testing occurred with teachers, TAs, SENCOs, students with ASC, their parents and carers, in a series of national testing and piloting events, arranged in two phases – The 'Alpha Phase' (a smaller, selected group of users) and 'Beta Phase' (a wider set of users to produce the final set of outputs for the Multiplier event).
- Acting as 'The Impact and Best Practices Report' a thorough evaluation of the usability of the O1, O2, O4 and O5 has been carried out in terms of effectiveness, improved skills and competencies for teachers to support personalisation, academic and social progress, and de-escalation of challenging behaviour in students with ASC.
- To achieve these aims, a longitudinal research and assessment approach was adopted, and the aim of testing and piloting with 30 teachers/users from special/inclusive education per country to be involved was easily exceed.
- Finally, this report contains recommendations for the implementation of O1, O2, O4 and O5 and the required adjustments that were made in these outcomes to make them ready for exploitation.

2 Piloting of the AI-TOP Outcomes

2.1 Introduction

In line with our evaluation processes, “quality” will be achieved by fulfilling our target group’s expectations for each output, and by meeting the expectations of the project partners on their potential to enable success for all learners with autism. It was agreed at the outset of the project that deliverables would not be finalised before all project partners have agreed on their quality within an internal project workshop, and all highlighted suggestions for improvement and iteration had been applied to each output.

Therefore, our project builds on an understanding of “quality” as the fulfilment of our target group’s expectations, and our outputs meet their needs and user requirements in terms of understanding their individual interests and what engages them. This provides personalisation in learning, and can also predict instances of challenging behaviour, so that well-tested interventions can be used by school staff and parents/caregivers to promote positive mental wellbeing.

The introductory quality monitoring activity occurred during the project kick-off meeting where the Steering Committee Board members set success indicators for the project and defined the criteria for quality outputs. Internal and external evaluation processes (led by P4) helped the consortium to systematically achieve its aims on a process level, while Quality Assurance approaches worked on the intellectual output level. It is worth noting that since the testing and piloting phases ran longitudinally throughout the project, partners presented their feedback on these processes as each of the monthly online and transnational partner meetings, to enable iterative cycles of optimisation of our Intellectual Outputs.

Tools for monitoring and control:

- Project Quality and Dissemination Plan – was used to facilitate a continuous discourse on how to further improve the project’s outcomes. It became a ‘living document’, iterated and developed over the course of the project.

- Evaluation of outputs in close cooperation with key stakeholders - of prime importance was the feedback from our network of schools, education bodies, researchers and experts in autism, parents, carers and circles of support in each of our partner countries. This was a key aspect in our project - strengthening collaboration among all actors in the field of autism within schools, families, and other external stakeholders. This process also had an external perspective, in that our project and its outcomes were evaluated by the organisations (schools, families, autism related end user organisations, students with autism, university researchers, etc) who participated longitudinally in the testing, piloting and iterative implementation of our project and its Intellectual Outcomes. Cooperation and communication with these stakeholders culminated in the organisation of our Multiplier Event (Nottingham, UK, July 2023). At the outset of the project, all partners confirmed the involvement of key stakeholders, using tools such as 'stakeholder mapping'.

- Testing and Pilot phases – Testing and review followed the principles of an iterative quality circle, where the initial versions of O1, O2, O4, O5 were thoroughly tested by a selected group of users (alpha testing – including teachers, teaching assistants, special education needs and coordinators, and young adults with learning disabilities and autism), while beta testing involved identified pilot users. This allowed the revision of these IOs in response to the collected feedback. The final outcome is an optimised set of project outcomes and O3: Optimisation of Autism Engagement and Meltdown Framework.

From a practical point of view, this meant that in the first phase of our project (Alpha Phase), iterative testing of the draft versions of the project outputs took place (before the actual piloting), to validate that these outcomes were reliable, and directly addressed the project objectives and that they had the potential to change practice within schools concerning the education of students with autism. This phase ran from the project inception through to June 2022, and culminated in important events such as the workshop with teaching staff at the Oak Field School in Nottingham, UK (June 22). In this event, the project IOs, and notably the 'Action Recognition Model' that was able to detect the involuntary gestures students with ASC make when approaching a meltdown event (touching ears, touching face, rocking, flapping hands, etc), were reviewed and feedback received for iteration.

In the second phase (Piloting – running from June 22 until the Multiplier Event), a wide range of events were held in the UK, Bulgaria, Greece and Belgium and feedback gathered on the usability, quality and potential for impact of project's IOs. The project's schedule of monthly online and periodic transnational meetings provided ample opportunity for partners to feedback to the wider partnership the key outcomes of these events and unpack the implications for further iteration of the IOs. In this way, all project outcomes were evaluated and tested thoroughly in collaboration with the target group during the testing and piloting activities for all IOs (database, App, Handbook and Pedagogical Framework). O2 (the App) especially was subject to a continuous cycle of improvement using an iterative design approach. Key stakeholders (see section 'Participants') were involved in the project from the very early phases and hence actively engaged in the ongoing vision for, refinement and upgrading of the outputs.

Key performance indicators:

- KPI 1: Active Participation of Target Groups
- KPI 2: Effectiveness of results
- KPI 3: Usability

2.1.1 The Pilot Plan

A Pilot Plan (See Annex 2) was created by O3 leader SoftQNR ahead of the piloting phase of the project. The main goal of the pilot plan was to ensure a common understanding of the pilot processes in each participating country (UK, BE, BG, and GR), as well as gather and evaluate all the outcomes so as to optimise the project's outcomes.

This pilot plan supported the iterative testing and national piloting via iterative testing during the period February 2022 – July 2023, split into two phases (Alpha and Beta) as described in section 2.1.

We planned to involve in total at least 30 users per country, encompassing teaching staff, parents and carers, autism researchers, local inclusive education authorities and students themselves where possible.

The Pilot Plan detailed:

- the piloting methodology that should be followed to successfully organise the pilots in United Kingdom, Belgium, Bulgaria and Greece.
- the descriptions of every pilot site, the number of persons involved.

- the time plan of the pilot phase.
- the results of the piloting in every country.
- questionnaires to guide and gather feedback from the participants in the pilot phase.

Testing and review followed the principles of an iterative quality circle, in that the initial versions of O1, O2, O4, O5 were thoroughly tested by a selected group of users (alpha testing), while beta testing involved all identified pilot users. This allowed the revision of these outputs in response to the collected feedback. The final outcome was an optimised set of project outcomes.

2.1.2 Aims of the Piloting

The aim of the piloting was to:

• Establish panels of 30 users in each pilot country to provide the basis for a rigorous review of all aspects (qualitative and quantitative) of outputs as designed and customised in O1, O2, O4, & O5.

• Evaluate thoroughly the Online Searchable Database, the Mobile Engagement and Meltdown Measurement App and accompanying Pedagogical Framework and Handbook in the UK, BE, BG, and GR, and extract best practices and proven pedagogical impact in schools-based practice for students with autism.

• Provide a blueprint for white papers, journal and conference outputs that support the application of the project tools including the Online Searchable Database, the Mobile Engagement and Meltdown Measurement App, and accompanying Pedagogical Framework and Handbook in school based and home settings. A range of these outputs can be seen in Table 3 – Impact.

2.2 Piloting Methodology

Methods

Testing, piloting and review followed the principles of an iterative quality circle, in that the initial versions of O1, O2, O4, O5 were thoroughly tested by a selected group of users (alpha testing), while beta testing involved a wider range of all identified pilot users. This allowed for the revision of our project IOs in response to the collated feedback, and as documented in O3. This was a longitudinal process, and events took place in a range of project stages and venues, using the guidance provided by the piloting materials, but it was emphasised that these could be adapted to suit the type of event and opportunities as they presented themselves to partners, so we react in an agile way to these opportunities for important end user feedback.

2.2.1 Piloter Profile

Target group:

Teachers, teaching assistants, and special education needs coordinators in mainstream education, inclusive settings, and special educational settings. Also included, were parents, carers, and those in the circle of support for students with ASC. Opportunities to work with students themselves were welcomed, guided by the Ethical Permission granted for such events (NTU's School of Science and Technology's Non-Invasive Ethics Committee – See Annex 1).

Prerequisites to participate:

- Basic digital skills
- Access to internet
- Access to PC or tablet or mobile phone
- E-mail
- Good level of motivation

2.2.2 Identification of Piloters

Before piloting could take place, a number of preparatory steps were required including identification of trainees, and engagement of the trainees in piloting. Table 2.1 summarises the participants in both the testing and piloting sessions in the Alpha and Beta phases of the project.

Country	IOs	Identification of piloters
Greece – PANEPISTIMIO THESSALIAS	O1 O2 O4 O5	**Alpha Phase:** **Events 1 -3:** • 20 undergraduate students and teachers of the department of special education of the University of Thessaly. • 15 Teachers working both in mainstream & special education since in Greece ASC students can attend mainstream schools with some support. • 10 parents and therapists working at all day centres for children with disabilities. **Event 4:** • More than 80 teachers, school heads, municipality representatives and policy makers in the field of education. **Beta Phase:** • 15 teachers
UK - Nottingham City Council & NTU	O1 O2 O4 O5	**Alpha Phase:** **Events 1-3:** • NICER Group members – around 20 young adults with learning disabilities and/or autism, their facilitator, and 2 Education Psychologists from NCC. **Event 4:** • 43 Teaching Staff including teachers, teaching assistants, SENCos and Head Teacher. **Event 5:** • Around 20 young adults with learning disabilities and autism attended the residential weekend. 9 Volunteered for the data collection sessions. They were accompanied by 4 teachers, 3

Country	IOs	Identification of piloters
		Teaching Assistants and 6 volunteers. Number of repeated sessions of data collection ranged from 1-3 for each volunteer. **Beta Phase:** **Event 1:** • 38 students and 15 teaching staff across 5 Nottingham Schools for students with autism. **Event 2:** • 8 teachers and autism education specialists working for local education authority. **Event 3:** • 8 NTU Researchers from Education, Psychology and Social Sciences. **Event 4:** • panel members and around 25 international researchers in Computer Science, AI and Machine Learning. **Mulitplier Event:** In the final Multiplier Event (July 23), 46 participants took part in the Multiplier Event at NTU. The breakdown of participants was as below: • Teachers: 17 • Tas: 5 • SENCos: 5 • Academic staff: 14 • Researchers: 9 • Autism Team/school advisors: 8 • Psychometric assessor: 1 • Nurture lead: 1 • Parent of someone with autism: 1 • Head Teacher: 1 • People with Autism: 1 Presentation sessions were run by the project team including Professor David Brown, Dr. Mufti Mahmud and Arif Rahman, NTU, Dawn Clarke and Fiona Gray of the NCC Autism Team, and Georgia Karagianni, University of Thessaly. Demos were given by the wider NTU Research Team, including Andy Burton and Nick Shopland (Research Fellows).

Country	IOs	Identification of piloters
Bulgaria – SDRUZENIJE NA NA RABOTESHTITE S HORA S UVREZHDANIYA	O1 O2 O4 O5	**Alpha Phase:** Around 31 school age students with autism spectrum disorder and their parents, accompanied by teachers. **Beta Phase:** **Event 1:** 28 teachers and 1 school psychologist. **Event 2:** NAB members and teachers from 2 mainstream schools in Plovdiv. **Event 3:** 36 mainstream teachers and 43students with ASC from 5 schools. **Event 4:** 36 mainstream teachers.
Belgium – PHOENIXKM BVBA	O1 O2 O4 O5	**Alpha Phase:** Around 21 school age students with autism spectrum disorder and their parents, accompanied by teachers. **Beta Phase:** **Event 1:** 15 teachers. **Event 2**: 4 NAB members (teachers, parents, caretakers). **Event 3:** 15 mainstream teachers and 21 students with ASC from local schools in Handzame, Kortemark, Gits, Ieper, Roeselare. **Event 4:** 15 mainstream primary teachers.

Table 2.1 summarises the participants in both the testing and piloting sessions in the Alpha and Beta phases of the project.

2.2.3 Stages of Piloting - Time Schedule

Alpha Phase Piloting took place from project inception to June 2022, Beta Phase Piloting took place in the period from autumn 2022 until June 2023. A number of induction training sessions, midterm review of progress and face-to-face piloting sessions were set for each partner.

2.2.4 Materials

For the face-to-face testing and piloting sessions, the following materials were made available by each partner:

- Course material
- PowerPoints for each output:
    - O1 - Online Searchable Database
    - O2 - Transferred Mobile Engagement and Meltdown Measurement App
    - O4 - Handbook for Teachers and Parents
    - O5 - Pedagogical Framework for Students with Autism

To prepare for the group piloting session participants (trainers, mentors, instructors) were instructed to:

- Familiarise themselves with searchable database structure (O1), mobile application (O2), handbook for teachers and parents (O4) and pedagogical framework (O5).
- Read through the participant handouts.
- Gather feedback: at the end of the testing and piloting sessions, partners collated training data, ad-hoc feedback, and completed the feedback evaluation questionnaires.

3 Alpha Phase Testing

Table 3.1 presents details and outcomes from the Alpha Testing phase for each partner country. Dates and venues, profile of testers, IOs tested and key feedback points used by the project team for the iterative development of the IOs are summarised.

Alpha Testing (UK, Greece, Bulgaria, Belgium)
Alpha Testing Events in the UK
Event 1 – NICER Group Feedback
Date and Venue: 23/09/21, Oak Field School, Nottingham UK.
Profile: NICER Group members, their facilitator, and 2 Education Psychologists from NCC.
IOs Tested: O2
Key Feedback Points for Iterative Development: Points taken into consideration for iterative design and development of the system: • A Focus Group approach was taken for this co-design session. • School staff noted that there are dedicated classes for students with autism within the Oak Field School which will be useful for the interleaved iterative development, testing and piloting stages of the AI-TOP project. 10 students with autism in total; 9 in KS2 and 1 in KS3. • The members of the group made the point that students with autism might not necessarily tolerate watches. • One member made the point that sensors could be placed on chairs, as many students with autism fidget when stressed. Another member raised concerns that students might not want to be 'watched'.
Event 2 – NICER Group Feedback
Date and Venue: 27/01/22, Oak Field School, Nottingham UK.
Profile: NICER Group members, their facilitator
IOs Tested: O5
Key Feedback Points for Iterative Development: The group provided feedback for the iterative design of the interview protocol which would provide the content (via Thematic Analysis) for O5 – The Pedagogical Framework.
Event 3 – NICER Group Feedback
Date and Venue: 09/05/22, Oak Field School, Nottingham UK
Profile: NICER Group members, their facilitator.
IOs Tested: O2

Key Feedback Points for Iterative Development: The group helped to plan the Alpha Testing Day with around 40-50 staff members expected to be present.

- It was felt that there should be plenty of opportunity for hands-on sessions with the equipment.

This was also an opportunity for staff to meet and talk to the researchers in the project, to give open and honest feedback.

Event 4 – Oak Field School Staff Workshop

Date and Venue: 13th June 2022, Oak Field School, Nottingham UK.

Profile of Testers: 43 Teaching Staff including teachers, teaching assistants, SENCos and Head Teacher.

IOs Tested: O1 and O2

Key Feedback Points for Iterative Development:

O1:

- Comprehensive set of resources available.
- Should link to other projects the school has been involved with (e.g., ViPi).

O2:

- First version of the model was demonstrated. shows some loss in the tests so far - due to small training sample for a deep learning model.
- Our project is targeting a wide range of students within the umbrella of ASC – the App should be sensitive to the needs of such students.
- If possible, add some sensing of physiological data to the Action recognition model.
- Some of the teachers and psychologists noted that once students begin to make the involuntary gestures connected with 'rumble moments' (e.g. touching face and ears), they are already well on the way to a 'meltdown' event.
- The use of existing open access datasets for meltdown would be useful for training our transferred algorithms.
- In addition, the algorithm should be fine-tuned with data gathered with a wide range of students with autism across our partner countries. Data should be collected over a balanced set of users in terms of age and gender, in a range of settings (special and inclusive schools, varying countries).
- Approaches to developing labels for these training data should be co-developed with the autism specialists working in our project (e.g., NCC Autism Team) and contained within the 'Observational Behavioural Checklists'.
- Should the system work with additional sensors (in addition to cameras) e.g., for temperature thermal camera, watch, patch? Smart watch provides more data - but we understand that it will not be worn by all users (of note, see the interview data collected as part of O5. Indeed, the findings from the Thematic Analysis should guide the iterative development of the App and its associated technologies).
- Understanding what engages each student is as important as what dysregulates them.
- The term 'meltdown' might not be used in all settings. An alternative of 'emotional dysregulation' was suggested.

O3 - The school has a special autism class and iterative testing of IOs was suggested to be carried out in collaboration with the school.

O4 – The School was previously involved in the Pathway+ project from which the Handbook is transferred.

O5 – The school provides teaching staff for interviews from which the Thematic Analysis guides the development of the Pedagogical Framework.

Event 5 – Data Collection to optimise Algorithm 1 for Action Recognition Model with the NICER Group

Date/Venue: Hathersage Residential Centre, 17th-19th June, 2022.

Profile of Testers: Around 20 young adults with learning disabilities and autism attended the residential weekend. 9 Volunteered for the data collection sessions. They were accompanied by 4 teachers, 3 Teaching Assistants and 6 volunteers.

Description of Activities:

- DB gave a description of the project, its aims and objectives.
- Participants who volunteered, signed the consent form.
- Participants performed the set of actions to train the Action Recognition Model (touch face, touch ears, scratching, flapping hands, etc.)
- Participants were invited to repeat their sessions if possible. The number of repeated sessions ranged from 1 to 3 for each participant.

Impact on iterative development of O2: In total, 9 students provided data to develop the Alpha version of the Action Recognition Model, over 1-3 repeated sessions.

Alpha Testing Events in GR

Events 1 – 3: Engagement sessions with teachers working both in mainstream & special education.

Dates/Venues: 27/9/2021, 29/9/2021 and 19/10/2021, University of Thessaly.

Profile of Testers:

- 20 undergraduate students and teachers of the department of special education of the University of Thessaly.
- 15 Teachers working both in mainstream & special education since in Greece ASC students can attend mainstream schools with some support.
- 10 parents and therapists working at all day centres for children with disabilities.

Outputs tested: O1 & O5

-During the first meeting undergraduate students of the Department of Special Education of the University of Thessaly and teachers working at the Department were presented with O1 (online database) and received guidelines on how to exploit the resources. They were also presented with O5 and were asked to discuss the draft questions for the semi-structured interviews.

-The second event was addressed to public education teachers, and focused on presenting O1 and the methodology for data collection within O5 which was about to take place. Teachers reflected on the questions and provided feedback on the areas they covered, and this feedback was used to provide a final version of the interview protocol. They were also encouraged to explore the O1 database and provide feedback.

The third event involved parents and therapists and it introduced them to O1 & O5 since some of them would be later recruited to be the interviewees.

Description of Activities: All activities aimed at familiarising teachers, parents, therapists, and future SEN teachers, with both O1 & O5, and to provide feedback for the project team to further exploit their practicality and usefulness while working with ASC students.

Parents and therapists found many of the practices in O1 very useful and they expressed their interest in participating in the interview to provide the content for O5 and in receiving information on the final results and outcomes of the project.

Key Results and implications for iterative Development per IO:

O1: Teachers found O1 really useful, and they stated that it would help them extend their knowledge of ASC and especially in how to predict and handle meltdowns. Moreover, they felt that this output fills a gap in their in-service training which seems not to be fully updated on this topic. O1 was found to provide theoretical knowledge which they largely lacked, and it also allowed access to a collection of good practices they could adopt in their classrooms. The same opinion was prevalent among parents and therapists also attending these sessions.

O5: All end users involved in the events reviewed the questions of the Interview Protocol that provided the content for O5, and specific questions on the semi-structured interviews. They expressed their willingness to participate and contribute in any possible way.

Event 4 - Awareness events for teachers working in both primary and secondary education in public schools.

Date/Venue: 25 & 26 /10/2021, at two-day multiplier event for a partner Erasmus+ project (SOS Schools)

Overview of testers: more than 80 teachers, school heads, municipality representatives and policy makers in the field of education.

IOs Introduced: O1, O2, O4, O5

Description of Activity/Session: 2 informative events

Key Results and implications for iterative Development: All participants found the project very interesting and innovative, but they seemed rather sceptical on the use of devices within the school classroom. This information was particularly useful for the ongoing development of O4 and O5.

Alpha Testing in BE

Engagement and individual meetings with parents and their children with autism

Dates/Venues: May - December 2021 and January – May 2022, School Network in BE.

Profile of Testers: Around 21 school age students with autism spectrum disorder and their parents, accompanied by teachers.

IOs tested: O1, O2, O5

Description of Activity/Session: Database content was appreciated, as it helped to identify educational approaches for ASC students**.**

Key Results and implications for iterative Development per IO: O1: Some additional entries were made for Belgium. O2: The application should run on a mainstream laptop, not on expensive devices. O5: Clear explanations will be needed.
Alpha Testing in BG
Engagement and individual meetings with parents and their children with autism
Dates/Venue: 25/06/2021, 14/10/2021, 29/10/2021, 26/11/2021, 03/12/2021, 13/12/2021, 07/01/2022, 11/01/2022, 21/01/2022, 07/02/2022, 16/02/2022, 01/04/2022, 30/05/2022 **Overview of testers:** Around 31 school age students with autism spectrum disorder and their parents, accompanied by teachers. **IOs tested:** O1, O2, O5 **Description of Activity/Session:** Presentation of database with good practices and verifying of data from the structured interviews, collection of ideas for the functionality of the application. **Key Results and implications for iterative Development per IO:** O1: The parents provided feedback about the practices, included in the database and also suggested several additional practises to be included. They determined the database navigation as easy and useful. O2: The application should be easily installed and its functionalities should allow non-invasive monitoring of the students` behaviour and engagement. The app should be compatible with different devices - even older ones. O5: Parents reviewed the list of questions for the interview as well as the available interview scripts. The parents clarified some peculiarities concerning diagnosing children with autism and their enrolment in the mainstream schools. Some parents expressed their concern that the school readiness for using AI should be increased. For that reason, the pedagogical framework should explain how the teacher could make use of AI in order to create classroom environment with limited triggering factors.

Table 3.1 Summary of details and outcomes from the Alpha Testing Phase for each partner country.

4 Beta Phase Piloting

Table 4.1 describes all opportunities for feedback with end users occurring between Autumn 2022 and July 2023 and the outcomes of these sessions in terms of the ongoing improvement of the IOs , including any usability issues, effectiveness issues and impact in terms of how the specific IOs will improve practitioner skills and competencies.

End Users described in terms of:

- Teachers, teaching assistants, and special education needs coordinators in mainstream education, inclusive settings, and special educational settings.

- Beneficiaries: students with ASC, and their families.

- Stakeholders: policy makers, pedagogical experts, schools, school authorities and their umbrella structures all over Europe. Service providers supporting students with ASC; local education authorities at all levels, Associations for teachers and teacher unions.

Beta Testing (UK, Greece, Bulgaria, Belgium)		
Beta Testing Events in the UK		
Event No/Groups	**Date/s**	**Description of Activity/Session**
1. Iterative Development with Nottingham Schools for students with Autism	March - June 2023	**Overview of testers:** 38 students and 15 teaching staff at the following mainstream Nottingham Schools which include students with autism: • Windmill Academy Primary • Nottingham Academy Primary • St Ann's Well Primary • Bluebell Hill Primary • Rosehill Primary **IOs Introduced/tested/iterated:** O1**,** O2, O4, O5 **Description of Activity/Session:** 3 introduction sessions and 9 working sessions. **Key Results and implications for iterative Development:** Data generated from 39 students over 9 sessions for the fine tuning of our algorithms and iterative development of the App (O2) as envisaged in our original project application – "O2 (the App) will be subject to a continuous cycle of improvement using an iterative design approach."

2. Workshop with NCC Autism Team	11/10/22	**Overview of testers:** 8 teachers and autism education specialists **IOs tested/iterated: O1, O2, O3, O4, O5** **Description of Activity/Session:** Online workshop with NCC Autism Team, where the project and its IOs were introduced and feedback solicited from the NCC Autism Team. **Key Results and implications for iterative Development:** Provided key feedback especially for the ongoing iterative development of O4 and the selection of sites for the gathering of students' data to facilitate the iterative development and finetuning of the App (O2).
3. Feedback opportunities from Autism related university researchers	27/04/22	**Overview of experts and researchers in Autism:** 8 NTU Researchers from Education, Psychology and Social Sciences **IOs receiving Feedback:** Project Methodology and O2. **Description of Activity/Session:** • David Bown presented an overview of the project methodology and approach to monitoring students' emotional states related to learning and behaviour. • Lauran Doak (Chair) chaired a session to gather feedback from the researchers on the project methodology and O2 approach. **Important points raised by these researchers to feedback into iterative development of the project:** • Is it possible or even desirable for students to always be engaged in learning? • Can students' emotional states related to learning really be broken down into 3 states? (engagement, boredom and frustration).

		• Autism is not a medical condition to be fixed. • Our approaches could be used to support the "Communication Passports" developed for students with autism in collaboration with university researchers. This is especially relevant to impact and transferability potential of the AI-TOP project and its related IOs.
4. Feedback Opportunities from Informatics related university researchers	The 15th International Conference on Brain Informatics (BI2022), Padova, Italy, July 15-17, 2022 - https://bi2022.org/ Friday, 15 July 2022	**Overview of experts and researchers in Autism:** 4 panel members and around 25 international researchers in Computer Science, AI and Machine Learning. **IOs receiving Feedback:** Project Methodology with feedback relevant to O2, O4 and O5 **Description of Activity/Session:** Panel Discussion on "Application of Artificial Intelligence Towards Inclusiveness and Personalisation for Students with Learning Disabilities and Autism" **Feedback was solicited on:** • The key challenges and opportunities related to the use of AI in supporting students with autism. • The ethical issues of using AI in the education of students with Autism. • Potential security issues (e.g., data breach, anonymisation,…) • How AI can be successfully used in the classroom (e.g., personalised pathway, challenging behaviour)
Beta Testing Events in GR		
Event No/Groups	**Date/s**	**Description of Activity/Session**
1. Piloting with teachers	2/4/2023	**Overview of testers**: 15 teachers **IOs tested/iterated**: O1, O2, O4, O5 **Description of Activity/Session:** Piloting of O1, O2, O4 & O5 with primary and secondary school teachers **Key Results and implications for iterative development and project impact:**

		O1→ Teachers said that they identified strategies that can be adopted in their own school teaching practices and could be effective after proper adjustment based on each one's students' needs and profiles. **O2→**The teachers found it really enlightening to be able to detect not only pre-rumble stages but also their students' engagement. **O4→** The teachers appreciated very much the existence of a guide that could show them how to use AI in order to improve behaviour, attendance and engagement of ASC students. **O5→**The teachers found it extremely useful that the Pedagogical Framework includes examples and study cases that depict challenging behaviours along with tips on how to deal with them.
2. NABs	Throughout the project	The Greek NAB consisted mainly of university professors working in the field of Autism, as well as educators and therapists working with children with ASC. All the outputs were highly appreciated as they were believed to act proactively for teachers and people working with students with ASC. The university professors suggested that outputs such as O4 & O5 could be added as training material for the purposes of in-service teacher training and/or in undergraduate students of pedagogical departments, specialising in ASC.
Beta Testing Events in BE		
No/Groups	**Date/s**	**Description of Activity/Session**
1. Training workshop for teachers from mainstream schools to introduce and discuss the content of the IOs as well as to provide copies	November-December 2022	**Overview of testers:** 15 teachers **IOs tested/iterated: O1, O2, O4, O5** **Description of Activity/Session:** Presentation of current versions of IOs, questions and answers, discussion about necessary conditions for the use of the application in the mainstream classroom. **Key Results and implications for iterative Development:**

	for individual self-time		Teachers were impressed with demonstrations. They indicated needs for practical cases that illustrate how the application can benefit both the teachers and the students, explaining the before and after situation, indicating what to do in case of an actual meltdown. This could be part of O4.
2.	Meeting with NAB members to support the pilot phase	April-June 2023	**Overview of testers:** 4 NAB members (teachers, parents, caretakers). **IOs Introduced/tested/iterated:** O1**,** O2, O4, O5 **Description of Activity/Session:** Demonstration of IOs and collection of comments and recommendation. **Key Results and implications for iterative Development:** O1 – Interesting to see also practices from other countries than just Belgium. Easy to navigate the online database platform. O2 – A much improved version at the end which highlighted that concerns were taken onboard in the final version. O4 – Straightforward and easy to use. O5 – The Pedagogical Framework provides great assistance in planning and guiding teachers for educating students with ASC in inclusive education settings. The case studies proved to be very handy for the engaged teachers, allowing to better understand why and how the application works.
3.	Meetings with teachers and students, iterative development with schools from Kortemark/Ieper region, including students with ASC	March - June 2023	**Overview of testers:** 15 mainstream teachers and 21 students with ASC from local schools in Handzame, Kortemark, Gits, Ieper, Roeselare. **IOs Introduced/tested/iterated:** O1**,** O2, O3, O4, O5 **Description of Activity/Session:** 4 intro sessions and 21 working sessions. **Key Results and implications for iterative Development:** Data generated from 21

		students over 21 individual sessions for training fine tuning of our algorithms and iterative development of the App (O2).
4. Iterative testing of the IOs by teachers and other educational specialists individually under the supervision of the Belgian partner	April – June 2023	**Overview of testers:** 15 mainstream primary teachers. **IOs Introduced/tested/iterated:** O1**,** O2, O4, O5 **Description of Activity/Session:** After instructions by the Belgian partner, all piloters were invited to explore the content of the IOs and to provide any further recommendations if any. **Key Results and implications for iterative Development:** Overall very positive feedback, with comments made that the outcomes could be easily adjusted and improved for other application domains, such as adult and VET educational settings, where a larger portion of the students are expected to have ASC.
Beta Testing Events in BG		
No/Groups	**Date/s**	**Description of Activity/Session**
1. Training workshop for teachers from mainstream schools to introduce and discuss the content of the IOs as well as to provide copies for individual reflection and feedback.	11/11/22	**Overview of testers:** 28 teachers and 1 school psychologist **IOs tested/iterated: O1, O2, O3, O4, O5** **Description of Activity/Session:** Presentation of current versions of IOs, questions and answers, discussion about necessary conditions for the use of the application in the mainstream classroom. **Key Results and implications for iterative development:** The teachers provided ideas about the gathering of students data to facilitate the iterative development and fine tuning of the App (O2): 1. The students should feel calm and should not be stressed before starting the session. 2. Pictures/illustrations used in the app should be in light colours and should

		not be interpreted by the child in a dual way, for example the cat should look exactly like a cat, not like a puma. 3. The app should detect warning signals for the change of mental state of the student, for example increased heart rate, sweating, wandering gaze etc. The teachers also provided feedback about the development of O4. According to the piloters, this is the most practical training material, which allows teachers to obtain practical skills to improve classroom environment for ASC students. Section "What`s next" should be further developed to support teachers in managing the consequences after the app detects an approaching meltdown. Some concrete examples for coping with emotional dysregulation could be included, however, they should be applicable to the mainstream classroom environment.
2. Meeting with NAB members to support the pilot phase	2-3 April 2023	**Overview of testers:** NAB members and teachers from 2 mainstream schools in Plovdiv. **IOs Introduced/tested/iterated:** O1**,** O2, O4, O5 **Description of Activity/Session:** 2-days workshop for demonstration of IOs and collection of comments and recommendation. **Key Results and implications for iterative Development:** The participants provided feedback about the latest versions of the IOs. O1 – The database is complete, comprehensive and does not require any modification. This product can be easily transferred to pre-school education and even to higher education. O2 – The app provides key features to trace the students` engagement and warn about

		meltdown events. The app should augment teachers` observations rather than replacing them. Only teachers should receive notifications from the app about students` disengagement or an approaching meltdown. Just eye tracking is not enough to analyse ASC student`s behaviour and level of engagement. It is much more complex and involves body posture, facial expression, vocalising and even ability to decline requests. O4 – The current content is useful and guides teachers through the process of installation and use of the app and suggestions about further actions to ensure environment without triggering factors. Teachers can use this training material fully independently as it offers screenshots, examples and practical activities. O5 – The pedagogical framework is useful on a strategic level for planning and managing of school policies for educating students with ASC. The content is very beneficial, especially for school directors, head teachers and coordinators of support teams for the education of students with ASC. Country specific case studies could be added to the national version.
3. Meetings with teachers and students, iterative development with schools from Plovdiv region, including students with ASC	March - June 2023	**Overview of testers:** 36 mainstream teachers and 43 students with ASC from the following schools: “St. Paisii Hilendarski” Secondary School, Plovdiv “Elin Pelin” Secondary School, Plovdiv “Miladinovi Brothers” Secondary School, Plovdiv “Zachari Stoyanov” Primary School, Plovdiv “Secret Garden Montessori” Primary School, Plovdiv **IOs Introduced/tested/iterated:** O1**,** O2, O4, O5

		Description of Activity/Session: 9 intro sessions and 43 working sessions. **Key Results and implications for iterative Development:** Data generated from 43 students over 43 individual sessions for training fine tuning of our algorithms and iterative development of the App (O2). Each individual session with the student was facilitated by teacher and all ethical and safety standards set by the project were observed. In this way, the IOs of the project were put into practice and tested within real school environments.
4. Iterative testing of the IOs by teachers and other educational specialists individually under the supervision of the two Bulgarian partners	April – June 2023	**Overview of testers:** 36 mainstream teachers **IOs Introduced/tested/iterated:** O1**,** O2, O4, O5 **Description of Activity/Session:** After instructions by the two Bulgarian partners, all piloters were invited to explore the content of the IOs and to provide any further recommendations if any. A final workshop for discussing opportunities for exploitation and sustainability of the project results was scheduled for the second part of August. **Key Results and implications for iterative Development:** The final recommendations of the piloters were centred around translation and adaptation of the materials in order to be applicable in the Bulgarian educational system. For example, O4 was described as very helpful, however, some of the guidelines should be adapted as in our system we do not have systemised and commonly used charts like ABC and Star chart. The current version of the application worked steadily and could be easily used by the teacher, but in the future additional function for profiling and customising for each child with ASC may be included for more advanced users. As evidence from the completed feedback form, the teachers in Bulgaria have found the AI-TOP IOs well-structured, practical and innovative in terms of use of AI. The teachers also welcomed the

		collaborative mechanism between the teacher and the new technologies heavily promoted by the AI-TOP project.

Table 4.1 - Opportunities for feedback with end users occurring between Autumn 2022 and July 2023 and the outcomes of these sessions

5 Impact and Best Practices - Innovation, Impact and Transferability Potential

Table 5.1 summarises feedback from our end users and stakeholders gathered through the activities of the Alpha and Beta Phases of the project concerning the Innovation, Impact and Transferability Potential of the IOs.

Innovation, Impact and Transferability Potential
Innovation: The advantages and opportunities afforded by the Online Searchable Database, the Mobile Engagement and Meltdown Measurement App and accompanying Pedagogical Framework and Handbook. **O1 -** The Online Searchable Database provides teachers, TAs, SENCOs, Parents and Carers with a searchable compendium of innovative and leading practices, tools, and resources to support the needs of students with autism in the classroom, including approaches to provide personalisation, improve the understanding of autism and address negative perceptions especially in the wider community, provide calm learning spaces, with decreased instances of challenging behaviour leading to improved mental wellbeing of ASC students, and improved access to innovative teaching of academic, independent living, adaptive behaviours and social skills. Feedback from Belgium stakeholders stated that O1 gave very practical examples and guidelines in the database, which is easy to navigate. Feedback from Bulgarian Stakeholders stated that O1 includes variety of materials and resources different formats, such as videos, publications, visual aids, academic papers, and contemporary approaches to accommodate various learning needs among students with ASC. It also highlights different ways to reduce emotional dysregulation of such students and to help them better adapt to the mainstream classroom environment. It also contains materials with guidelines and ideas for creating sensory-friendly classroom environments, taking into account sensory sensitivities that are common among students with ASC. The users can find publications with the latest research findings and evidence-based practices for supporting students with ASC in the school environment. With the specific focus on their emotional and behavioural support, rather than on obtaining academic skills. Summative Feedback from the Multiplier Event stated that the database was seen as a useful tool by all (100%) participants, though one pointed out that it would be even more helpful if the focus was on the more practical guidance over the items that give academic guidance. It was also felt by all participants that the database could be adopted by any school parent or carer. **O2:** 100% of respondents of the survey conducted at the Multiplier Event thought that the mobile app has the potential to change/augment practice in schools supporting students with ASC. The majority (86%) thought that the mobile app could be used by any school, parent or carer, though it was suggested that the technology may not be practical in a large class of pupils in mainstream, and that the practicalities would be dependent on individual children, parents or carers. It was also expressed that the app may interfere with helping students to recognise and regulate their own emotions.

O4 - The handbook provides support to Teachers/SENCOs/TAs, as well as Parents and Carers on the usage of the App to infer engagement and teaching interventions that can be altered to keep learners with autism in an optimal state of learning and predict the 'rumble' stages of 'meltdown' events so that instances of challenging behaviour can be reduced. This leads to improved mental wellbeing. These innovations are unique.

BE – Great guidelines towards the application usage.

BG – The handbook provides some innovative ideas inviting teachers to apply positive reinforcement strategies to encourage and reward desired behaviours. By shifting teacher's focus from the maladaptive behaviour to manifestations of positive attitudes. All participants in the educational process can contribute to the development of welcoming environment promoting harmonious relationships. Both parents and teachers can find ideas for meltdown management as well as de-escalation techniques during challenging moments.

GR - The project's outputs have impacted future teachers who are under graduation at the University of Thessaly as they received important information on what ASC is, what are the signs of a meltdown and how these challenging behaviours can be predicted and managed in an effective and child-friendly way, without exposing children and/or stigmatising them. Currently, they are also being used by school advisors and teacher trainers for in-service teacher training, both in mainstream and special (inclusive) education.

In particular, these future teachers noted that the handbook is free to use and enables Teachers/TAs/SENCOs to use the AI-TOP app to understand the level of engagement of students with autism in classroom learning activities, and to predict 'meltdown' events at the 'rumble' stage.

Teachers, support staff, parents and carers can use this information to:

• Provide personalised learning pathways and support according to the specific needs of each child with autism.

• Improve the understanding of autism both within school, and in the wider community.

• Provide a learning environment free of emotional trauma.

• Increase the likelihood that students with autism will make the academic and social progress that they should.

• Decrease incidents of challenging behaviour, leading to improved mental wellbeing of individual students, and decreasing instances of absenteeism and bullying.

• Improve access to teaching of academic, independent living, adaptive behaviours and social skills.

• Help prevent secondary consequences such as anxiety disorders and depression.

The ratification of the Convention on the Rights of Persons with Disabilities (UNCRPD) 2008, and in particular its article 24 on inclusive education, has had a drastic impact on how teachers need to act in inclusive education. Most teachers do not receive any additional training on how to cope with or support children with disabilities and special needs. AI-TOP offers a tool to be used with children with autism, in mainstream and special educational needs classrooms, to assess attention and engagement and to predict rumble and meltdown moments.

Feedback from the **Multiplier Event** concerning the Handbook and "what's next" section was that the consensus of responses (95%) was that this would be a useful document, and that the handbook would enable teachers to consider what to do next, should a meltdown event happen.

O5 - The majority of participants at the Multiplier Event (86%) thought that the pedagogical framework was a useful document.

Impact: All publications produced as a result of the AI-TOP project – including conference, journal or disability press oriented.

UK:

Turabee, Z.B. et al. (2023). The Use of Explainable Sensor Systems in Classroom Settings - Teacher, Student and Parent Voices on the Value of Sensor Systems. In: Antona, M., Stephanidis, C. (eds) Universal Access in Human-Computer Interaction. HCII 2023. Lecture Notes in Computer Science, vol 14021. Springer, Cham. https://doi.org/10.1007/978-3-031-35897-5_33 (O2, O5)

Bonacini, F., Mahmud, M., Brown, D.J. (2023). Towards the Development of a Machine Learning-Based Action Recognition Model to Support Positive Behavioural Outcomes in Students with Autism. In: Tanveer, M., Agarwal, S., Ozawa, S., Ekbal, A., Jatowt, A. (eds) Neural Information Processing. ICONIP 2022. Communications in Computer and Information Science, vol 1792. Springer, Singapore. https://doi.org/10.1007/978-981-99-1642-9_50 (O2)

Wadhera, T., Mahmud, M., Brown, D.J. (2023). A Deep Concatenated Convolutional Neural Network-Based Method to Classify Autism. In: Tanveer, M., Agarwal, S., Ozawa, S., Ekbal, A., Jatowt, A. (eds) Neural Information Processing. ICONIP 2022. Communications in Computer and Information Science, vol 1794. Springer, Singapore. https://doi.org/10.1007/978-981-99-1648-1_37 (O2)

Arent, K.; Brown, D.J.; Kruk-Lasocka, J.; Niemiec, T.L.; Pasieczna, A.H.; Standen, P.J.; Szczepanowski, R. The Use of Social Robots in the Diagnosis of Autism in Preschool Children. *Appl. Sci.* 2022, *12*, 8399. https://doi.org/10.3390/app12178399 (O1, O4, O5)

Haddick, S., Brown, D.J., Connor, B., Lewis, J., Bates, M., Schofield, S. (2022). Metahumans: Using Facial Action Coding in Games to Develop Social and Communication Skills for People with Autism. In: Antona, M., Stephanidis, C. (eds) Universal Access in Human-Computer Interaction. User and Context Diversity. HCII 2022. Lecture Notes in Computer Science, vol 13309. Springer, Cham. https://doi.org/10.1007/978-3-031-05039-8_25 (O1, O4, O5)

Rahman, M.A., Brown, D.J., Shopland, N., Burton, A., Mahmud, M. (2022). Explainable Multimodal Machine Learning for Engagement Analysis by Continuous Performance Test. In: Antona, M., Stephanidis, C. (eds) Universal Access in Human-Computer Interaction. User and Context Diversity. HCII 2022. Lecture Notes in Computer Science, vol 13309. Springer, Cham. https://doi.org/10.1007/978-3-031-05039-8_28 (O2)

Hughes-Roberts, T., Cui, V., Mahmud, M., Brown, D.J. (2022). Leveraging Virtual Reality and Machine Learning as Mediated Learning Tools for Social Skill Development in Learners with Autism Spectrum Condition. In: Antona, M., Stephanidis, C. (eds) Universal Access in Human-Computer Interaction. User and Context Diversity. HCII 2022. Lecture Notes in Computer Science, vol 13309. Springer, Cham. https://doi.org/10.1007/978-3-031-05039-8_16 (O1, O4, O5).

Transferability Potential: Use your experience of working in the project and with all external stakeholders and state how the IOs are transferable to other areas of research and implementation, such as the research on school-based practice for students with ADHD.

O1 - can be used and adopted by any school, or parent/carer in the wider community as it is available as a free and open educational resource. Its applicability for use in an inclusive education setting does not preclude its use for special schools, home settings, etc., making the collection a widely transferrable resource.

BE – Our NAB members and involved teachers saw great potential for setting up a similar database, but then for adult/VET education and higher education.

BG – Our database is available in multiple languages thus ensuring that it can be easily adopted by schools, parents, and caregivers in diverse linguistic communities, as it does not include country specific resources it can be applicable across different geographical regions. Most of the resources are downloadable and can be further used without permanent internet connection in this way they can be used in remote areas. Finally, the database can be easily transferred in other educational domains such as preschool, VET and even higher education, as it provides universal resources to prevent emotional dysregulation and meltdown, which may occur in different settings.

O2 - The app has been developed specifically with children with ASC in mind, but it had been suggested by many stakeholders that it holds use in children with other diagnoses such as ADHD, social, emotional and mental health (SEMH) difficulties, and could be of general use across the whole of mainstream education.

BE – The application is useful for many comorbidities too that often occur with children with ASC: Tourette, OCD, ADHD, etc. This offers opportunities for further research and development.

BG - The app could be widely used in the future for scientific purposes for example with the user consent, anonymised data can be shared for research purposes thus contributing to the broader understanding of how different factors (environmental, behavioural etc.) may lead to approaching meltdown. On the other hand, data can be collected regarding various factors influencing students' engagement during classes. The app can be also be used in different early childcare settings so that the specialists can be supported with an AI tool allowing them to detect early signs of anxiety for example among children with speech and language development delays.

Additional valuable feedback was given by participants at the Multiplier Event: For further applications of the technology, the respondents came up with some interesting ideas which can be applied to project sustainability activities:

- Use of the tool in group activities.
- Use with students with Social, Emotional and Mental Health (SEMH) difficulties to trigger time-out activities.
- The app should work on tablet and phone too (i.e. extend data tracking from laptop camera to also mobile devices).
- Use on whole class as it would be useful to monitor engagement across all students.

- Analysis tool would be very useful for the SENCo.
- It could be useful to monitor teaching staff – as managing their own emotional arousal levels is vital to optimise that of the other person in the communication partnership.

When asked for any additional comments, the respondents had some interesting insights, which have been categorised and paraphrased below:

Organisational:

- We should be wary that staff do not become over-reliant on data, and not use their skills and experience.
- The system relies on children being sat at a PC all the time. With our ASC children, we try to avoid ANY screens for many different reasons.

Technological:

- Needs to be on a portable device too for accessibility.
- Could there be a simple push notification to alert - and the ability to turn off flashing or vibration?
- To push this out to be able to scan multiple faces using one webcam would be beneficial so that tracking can be achieved when students are not doing computer-based work.

Personal:

- Have we considered the benefits of meltdowns for some students in terms of 'resetting' their mood?
- Some children with ASC do not change their facial expression very often and only very subtle body changes (e.g. agitated finger) tell us that they are getting dysregulated.
- There are particular idiosyncrasies in students with ASC, such as some pupils will look away but this is how they are focusing as it's a way of filtering out other information, and facial expressions cannot link to emotions, for instance one pupil can smile intently but this is part of their stimming behaviour due to their anxiety levels and not necessarily them being happy, this could be picked up as a neutral behaviour state but actually could be a sign of a rumble state.
- There is a need to consider how each child identifies their emotions.
- Young people with autism need to have a strong voice in its development in order to make the app as useful and practical as possible and also to help break down the traditional 'being done to' ideology which arises from the medical model of autism.

Table 5.1 Feedback from our end users and stakeholders gathered throughout the Alpha and Beta Phases of the project concerning the Innovation, Impact and Transferability Potential of the IOs.

6 Further Reading and Contact information

Project coordinator:

Nottingham Trent University, Nottingham, United Kingdom

Contact details: Professor David Brown, david.brown@ntu.ac.uk

Project Partners:

National Association of Professionals Working with People with Disabilities, Plovdiv, Bulgaria

Contact details: Petya Grudeva, info@narhu.org

SU Paisii Hilendarski, Bulgaria

Contact details: Silva Ikimova, silvaikimova@mail.bg

Phoenixkm BVBA, Kortemark, Belgium

Contact details: Karel Van Isacker, CEO, karel@phoenixkm.eu

SoftQNR D.O.O., Nis, Serbia

Contact details: Jelena Kocic, jel.kocic@gmail.com

Nottingham City Council, Nottingham, United Kingdom

Contact details: Fiona Gray: Principal Educational Psychologist, Fiona.gray@nottinghamcity.gov.uk

University of Thessaly, Greece

Contact Details: Georgia Konstantia Karagianni, Education Consultant - Ministry of Education, Religious Affairs & Sports jimfayo806@gmail.com

Annex 1: Data Collection and Piloting Ethics Documents

Study Description for Children with ASC

AI-TOP – A study to create an engagement tracking and rumble moment prediction technology for students with Autism Spectrum Disorder (ASC)

We will be watching how much you are enjoying your work with a camera, and listening to how fast your heart is going with a smart watch. By doing this, we can learn what the signs are that you are happy or sad in the classroom.

Then we will make a phone app which can guess when you are starting to get sad, or need a rest, or want to change what you are doing before you get too cross.

What is the purpose of this study?

We want to make something that can spot when you are starting to feel sad or uncomfortable before you get cross or upset, so that you can be given something else to do that will calm you down, like going to a quiet place, reading or listening to music.

What will I be expected to do if I take part?

All you have to do is do what you normally do at school, or sometimes we might ask you to play a computer game. There will be a camera watching you, and a watch if you can wear one comfortably. We will do it in your classroom or in a nearby room or space with people you know from school.

Will my taking part in the study be kept confidential?

We won't give any of the videos we take to anybody else – they will just be used by us to make the app to help you in school. We will never use your name in anything we write.

What will happen if I don't want to carry on with the study?

If you decide you want to stop doing any of the things we have asked, or need to take off the watch – you just need to tell us - or tell your teacher and you can stop straight away. We won't make you do anything you don't want to do, and your teachers will still be around to help you.

What will happen to the results of the research?

We might write about what we found out by working with you, but we will never tell anyone your name.

Thank you.

Andy

Contact Information
Dr. Andy Burton
E-mail: removed

Nottingham Trent University
Research Fellow

Study Description for Over 18s with ASC

AI-TOP – A study to create an engagement tracking and rumble moment prediction technology for students with Autism Spectrum Disorder (ASC)

Tracking a student's engagement with their learning and prevention of meltdown events has the potential to increase effective learning. A technology which could alert the you or a carer to signs of low engagement or early signs of a meltdown event could allow you to implement strategies to mitigate events. AI-TOP aims to develop this technology. To help you decide whether to take part, this sheet explains why the research is being done and what it would involve for you. Please kindly take the time to read the following information.

What is the purpose of this study?

People with ASC and the people surrounding them often face challenges in dealing with the wide variety of learning needs. The challenge of this project is to use sensor data which may include eye-gaze, facial expressions, heart rate, skin temperature and body posture as indicators, for gauging the engagement of participants, and for the prediction of rumble moments and meltdown events. This could in turn assist in the creation of personalised learning pathways, to ensure all students with ASC reach their full potential.

It is intended that an array of sensors will be used, selected from many possible available devices including smart watches, phones, iPads, wristbands, chest straps, cameras and eye trackers. These devices can measure a wide range of physiological, movement and visual data including heart rate variation, movement data, eye gaze, electrodermal activity and body pose. A machine learning algorithm will be developed to find the correlations between the fused sensory data, attention levels and rumble moments.

If successful, the technology will alert you or a nominated person to intervene using various approaches including calming measures - to maintain attention and engagement or to prevent rumble/meltdown events before they happen.

Testing and review will follow the principles of an iterative quality circle, in that the initial versions of the database, the developed app, the user manual/handbook, and the pedagogical framework will be thoroughly tested by a selected group of users (alpha testing), while beta testing will involve all identified pilot users. This will allow the revision of these outputs in response to the collected feedback, and the final outcome will be an optimised set of project outcomes and O3: Optimisation of Autism Engagement and Meltdown Framework.

We are testing in schools and envisage 30 teachers/country, from special/inclusive educational settings for students with autism. The UK. Bulgaria, Belgium, and Greece sites will be involved in running studies. We are also testing with parent/child dyads.

Key performance indicators will be as follows:

• Active Participation of Target Groups

• Effectiveness of results

• Usability

What will I be expected to do if I take part?

Researchers at NTU and our partner organisations in the project will be gathering data from students on the autism spectrum by having them wear and be tracked by sensor devices including cameras and physiological data. The data will be correlated with expert analysis (to be given by the teachers/parents/carers involved in the study) of when rumble/meltdown/engagement events happened to train an explainable artificial intelligence machine learning model. This model will then be used in the second phase of the project to predict rumble and meltdown events in order to allow for quick interventions to prevent them from occurring.

We are working to establish which technologies and sensors are most appropriate, useful and acceptable for you to use, to identify practical limitations and barriers in the implementation of these sensors and technologies in a real-life environment, and to identify the potential benefits which can be gained by the implementation of such technologies.

Where/how will the experiment take place?

We are flexible about your participation, and will endeavour to equip participants with sensors that they can tolerate without issue, but that will provide the most complete set of data for our algorithm to use. We are aware that not all participants will tolerate all types of sensors, and so have developed a flexible system which is able to take sensor inputs from a number of different sources. The experiment will be carried out within the child's normal classroom in school, or at home if working with a parent/carer.

Will it cost me anything to take part?

It will not cost you anything to take part. All costs are covered from the research budget. Equipment will be supplied but will need to be returned following completion of your participation.

Will my taking part in the study be kept confidential?

Yes. We will follow established ethical and legal practices and all information about you and your school/organisation will be handled confidentially. All information which is collected about you during the study will be kept strictly confidential and any information about you will have your name and identity removed prior to any analysis or publication of results so that you cannot be identified.

What data will be collected?

During the study data will be collected including video streams and physiological data (which may include galvanic skin response, heart rate variability, heart rate, etc depending on the devices used in each case). The data will be timestamped to allow correlation with events regarding, rumble, meltdown and engagement. Following labelling of the data, the labelled data will be used to create an explainable algorithm which will later be used to try and predict events and states of the students in the classroom.

Your informed consent will be requested for all the data collected in the study. For publication, all data will be anonymized and no records of name, or data leading to the identification of the participants will ever be made public.

What will happen if I don't want to carry on with the study?

Your participation is voluntary and you are free to withdraw up to 2 weeks after the experiment takes place, without giving any reason and without your legal rights being affected. If you withdraw the information collected from you will be destroyed.

What will happen to the results of the research?

It is intended that the results of the research will be published formally in scientific journals and published in end user community communications. You will not be identified in any report or publication.

Our genuine thanks for your time in reading this information pack.

Contact Information
Dr. Andy Burton
E-mail: removed
Nottingham Trent University
Research Fellow

Study Description for Teachers, Parents and Carers

AI-TOP – A study to create an engagement tracking and rumble moment prediction technology for students with Autism Spectrum Disorder (ASC)

Tracking a student's engagement with their learning and prevention of meltdown events has the potential to increase effective learning in schools. A technology which could alert the teacher to signs of low engagement or early signs of a meltdown event could allow the teacher to implement strategies to mitigate events in the classroom. AI-TOP aims to develop this technology. To help you decide whether to take part, this sheet explains why the research is being done and what it would involve for you. Please kindly take the time to read the following information.

What is the purpose of this study?

Teachers often face challenges in dealing with the wide variety of learning needs in inclusive classrooms that include students with autism spectrum disorder. The challenge of this project is to use sensor data which may include eye-gaze, facial expressions, heart rate, skin temperature and body posture as indicators, for gauging the engagement of students, and for the prediction of rumble moments and meltdown events. This could in turn assist in the creation of personalised learning pathways, to ensure all students with ASC reach their full potential.

It is intended that an array of sensors will be used, selected from many possible available devices including smart watches, phones, iPads, wristbands, chest straps, cameras and eye trackers. These devices can measure a wide range of physiological, movement and visual data including heart rate variation, movement data, eye gaze, electrodermal activity and body pose. A machine learning algorithm will be developed to find the correlations between the fused sensory data, attention levels and rumble moments.

If successful, the technology will alert the teacher who will then be able to intervene using various approaches including modified teaching techniques, learning material, classroom setups and environmental factors - to maintain attention and engagement or to prevent rumble/meltdown events in the classroom before they happen.

Testing and review will follow the principles of an iterative quality circle, in that the initial versions of the database, the developed app, the user manual/handbook, and the pedagogical framework will be thoroughly tested by a selected group of users (alpha

testing), while beta testing will involve all identified pilot users. This will allow the revision of these outputs in response to the collected feedback, and the final outcome will be an optimised set of project outcomes and O3: Optimisation of Autism Engagement and Meltdown Framework.

We envisage 30 teachers/country, from special/inclusive educational settings for students with autism. The UK. Bulgaria, Belgium and Greece sites will be involved in running studies.

Key performance indicators will be as follows:

• Active Participation of Target Groups

- Effectiveness of results
- Usability

What will I be expected to do if I take part?

Researchers at NTU and our partner organisations in the project will be gathering data from students on the autism spectrum in the classroom by having them wear and be tracked by sensor devices including cameras and physiological data. The data will be correlated with expert analysis (to be given by the teachers and parents/carers involved in the study) of when rumble/meltdown/engagement events happened to train an explainable artificial intelligence machine learning model. This model will then be used in the second phase of the project to predict rumble and meltdown events in order to allow for quick intervention by staff to prevent them from occurring.

We are working to establish which technologies and sensors are most appropriate, useful and acceptable for you and your students to use in the classroom, to identify practical limitations and barriers in the implementation of these sensors and technologies in a real-life school classroom environment, and to identify the potential benefits which can be gained by the implementation of such technologies.

Where/how will the experiment take place?

We are flexible about your participation, and will endeavour to equip participants with sensors that they can tolerate without issue, but that will provide the most complete set of data for our algorithm to use. We are aware that not all students will tolerate all types of sensors, and so have developed a flexible system which is able to take sensor inputs from a number of different sources. The experiment will be carried out within the child's normal classroom in school, or at home if working with a parent.

Will it cost me anything to take part?

It will not cost you anything to take part. All costs are covered from the research budget. Equipment will be supplied but will need to be returned following completion of your participation.

Will my taking part in the study be kept confidential?

Yes. We will follow established ethical and legal practices and all information about you and your school/organisation will be handled confidentially. All information which is collected about you during the study will be kept strictly confidential and any information about you will have your name and identity removed prior to any analysis or publication of results so that you cannot be identified.

What data will be collected?

During the study data will be collected including video streams and physiological data (which may include galvanic skin response, heart rate variability, heart rate, etc depending on the devices used in each case). The data will be timestamped to allow correlation with events regarding, rumble, meltdown and engagement. Following labelling of the data, the labelled data will be used to create an explainable algorithm which will later be used to try and predict events and states of the students in the classroom.

Your informed consent will be requested for all the data collected in the study. For publication, all data will be anonymized and no records of name, or data leading to the identification of the participants will ever be made public.

What will happen if I don't want to carry on with the study?

Your participation is voluntary and you are free to withdraw up to 2 weeks after the experiment takes place, without giving any reason and without your legal rights being affected. If you withdraw the information collected from you will be destroyed.

What will happen to the results of the research?

It is intended that the results of the research will be published formally in scientific journals and published in end user community communications. You will not be identified in any report or publication.

Our genuine thanks for your time in reading this information pack.

Contact Information
Dr. Andy Burton
E-mail: removed
Nottingham Trent University
Research Fellow

Consent Form (Data Collection and Piloting Stage) Adult

I, the undersigned, confirm that (please tick box as appropriate):

1.	I have read and understood the information about the project, as provided in the Information Sheet dated _____.	☐
2.	I have been given the opportunity to ask questions about the project and my participation.	☐
3.	I voluntarily agree to participate in the project.	☐
4.	I understand I can withdraw at any time without giving reasons and that I will not be penalised for withdrawing nor will I be questioned on why I have withdrawn.	☐
5.	I agree to video, audio and physiological data being collected during the research experiment.	☐
6.	The procedures regarding confidentiality have been clearly explained to me. (e.g. use of the recordings and data, names, pseudonyms, anonymization of data, etc.)	☐
7.	The use of the data in research, publications, sharing and archiving has been explained to me.	☐
8.	I understand that other researchers will have access to this data only if they agree to preserve the confidentiality of the data and if they agree to the terms I have specified in this form.	☐
9.	I, agree to sign and date this informed consent form.	☐

Participant:

_____	_____	_____
Name of Participant	Signature	Date

Researcher:

_____	_____	_____
Name of Researcher	Signature	Date

Consent Form (Data Collection and Piloting Stage) Under 18

I, the undersigned, confirm that (please indicate Y (Yes), or N (No):

1.	I have read and understood the information about the project, as provided in the Information sheet.	
2.	I have been given the opportunity to ask questions about the project and my participation.	
3.	I voluntarily agree to participate in the project.	
4.	I understand I can withdraw at any time up to two weeks following my participation without giving reasons and that I will not be penalised for withdrawing nor will I be questioned on why I have withdrawn.	
5.	The procedures regarding confidentiality have been clearly explained to me. (e.g. use of names, pseudonyms, anonymisation of data, etc.)	
6.	Terms of consent for audio, video, physiological or other forms of data collection have been explained and provided to me.	
7.	The use of the data in research, publications, sharing and archiving has been explained to me.	
8.	I understand that other researchers will have access to this data only if they agree to preserve the confidentiality of the data and if they agree to the terms I have specified in this form.	
9.	I, along with the Witness/Parent or Guardian, agree to sign and date this informed consent form.	

Participant:

_____	_____	_____
Name of Participant	Signature	Date

Parent/Guardian (if under 18) or Witness:

_____	_____	_____
Name	Signature	Date

Researcher:

_____	_____	_____
Name of Researcher	Signature	Dat

Co-funded by the
Erasmus+ Programme
of the European Union

Annex 2: Pilot Plan

"An AI Tool to Predict Engagement and 'Meltdown' Events in Students with Autism"

AITOP

Pilot Plan and Reporting

Section	Project management and implementation
Output Title	Pilot Plan and Reporting
Status	Draft
Project start date	01/09/2020
Project end date	31/08/2023
Author	SOFTQNR Serbia

Project Number: 2020-1-UK01-KA201-079167

1 Table of Contents

2 Introduction

The main goal of the pilot plan is to ensure a common understanding of the pilot process in each participating country (UK, BE, BG, and GR), as well as gather and evaluate all the outcomes so as to optimise the project's outcomes.

This pilot plan will support the iterative testing and national piloting via iterative testing during the period February 2022 – June 2023.

We plane to involve in total 30 teachers per country. They will be involved to allow to assess, evaluate and improve the created training materials.

This pilot plan will detail:

- the **piloting methodology** that should be followed in order to successfully organise the pilots in United Kingdom, Belgium, Bulgaria and Greece.
- the **descriptions of every pilot site**, **the number of persons involved**.
- the **time plan of the pilot phase**.
- the **results of the piloting in every country**.
- **questionnaires** to gather feedback from the participants in the pilot phase.

Testing and review will follow the principles of an iterative quality circle, in that the initial versions of O1, O2, O4, O5 will be thoroughly tested by a selected group of users (alpha testing), while beta testing will involve all identified pilot users. This will allow the revision of these IOs in response to the collected feedback. The final outcome will be optimised set of project outcomes and O3: Optimisation of Autism Engagement and Meltdown Framework.

Aims

The aims of the piloting is to:

• To establish panels of 30 users in each pilot country to provide the basis for a rigorous review of all aspects (qualitative and quantitative) of outputs as designed and customised in
O1, O2, O4, & O5.
• To evaluate thoroughly the Online Searchable Database, the Mobile Engagement and Meltdown Measurement App and accompanying Pedagogical Framework and Handbook in the UK, BE, BG, and GR, and extract best practices and proven pedagogical impact in schools based practice for students with autism.
• To provide a blueprint for white papers, journal and conference outputs that support the application of the project tools including the Online Searchable Database, the Mobile Engagement and Meltdown Measurement App, and accompanying Pedagogical Framework and Handbook in school based and home settings.

3 Profile of piloters

Target group

Teachers, teaching assistants, and special education needs coordinators in mainstream education, inclusive settings, and special educational settings.

Prerequisites to participate

- Basic digital skills
- Access to internet
- Access to PC or tablet or mobile phone
- E-mail
- Good level of motivation

Identification of Piloters

Before piloting can take place, a number of preparatory steps are needed:

- Identification of trainees
- Engage the trainees into piloting

Country	IOs	Size pilot	Identification of piloters
Greece - DIEYFTHYNSI DEYTEROVATHMIAS EKPAIDEYSIS N. KARDITSAS	O1 O2 O4 O5	At least: • trainers: 5	• DESCRIBE THE PROFILE OF PILOTERS (WHO WILL PARTICIPATE, AREA OF TRAINING SUBJECT OF THE PARTICIPANT), CONTACT DETAILS • DESCRIBE THE PROFILE OF INSTRUCTORS/MENTORS (WHO WILL PARTICIPATE, AREA OF TRAINING SUBJECT OF THE PARTICIPANT), CONTACT DETAILS • DESCRIBE THE PROFILE OF TRAINERS INVOLVED (WHO WILL PARTICIPATE, AREA OF TRAINING SUBJECT OF THE PARTICIPANT), CONTACT DETAILS
UK - Nottingham City Council	O1 O2 O4 O5	At least: • trainers: 5 •	• DESCRIBE THE PROFILE OF PILOTERS (WHO WILL PARTICIPATE, AREA OF TRAINING SUBJECT OF THE PARTICIPANT), CONTACT DETAILS

Country	IOs	Size pilot	Identification of piloters
			• DESCRIBE THE PROFILE OF INSTRUCTORS/MENTORS (WHO WILL PARTICIPATE, AREA OF TRAINING SUBJECT OF THE PARTICIPANT), CONTACT DETAILS DESCRIBE THE PROFILE OF TRAINERS INVOLVED (WHO WILL PARTICIPATE, AREA OF TRAINING SUBJECT OF THE PARTICIPANT), CONTACT DETAILS
Bulgaria – SDRUZENIJE NA NA RABOTESHTITE S HORA S UVREZHDANIYA	O1 O2 O4 O5	At least: • trainers: 5	• DESCRIBE THE PROFILE OF PILOTERS (WHO WILL PARTICIPATE, AREA OF TRAINING SUBJECT OF THE PARTICIPANT), CONTACT DETAILS • DESCRIBE THE PROFILE OF INSTRUCTORS/MENTORS (WHO WILL PARTICIPATE, AREA OF TRAINING SUBJECT OF THE PARTICIPANT), CONTACT DETAILS • DESCRIBE THE PROFILE OF TRAINERS INVOLVED (WHO WILL PARTICIPATE, AREA OF TRAINING SUBJECT OF THE PARTICIPANT), CONTACT DETAILS
Belgium – PHOENIXKM BVBA	O1 O2 O4 O5	At least: • trainers: 5	• DESCRIBE THE PROFILE OF TRAINERS INVOLVED (WHO WILL PARTICIPATE, AREA OF TRAINING SUBJECT OF THE PARTICIPANT), CONTACT DETAILS

4 Stages of Piloting

Time Schedule

Alpha Testing (project inception-June 22) and Piloting (autumn 22 – June 2023). A number of induction training sessions, midterm review of progress and face to face piloting sessions will be set for each partner. The virtual internship support will be estimated/organised based on individual preferences expressed by each partner. Since the project addresses blended virtual internship (face to face, online support), these different sessions should be planned and detailed in the below template.

Apart from this, we will have several iterative circles.

Greece - DIEYFTHYNSI DEYTEROVATHMIAS EKPAIDEYSIS N. KARDITSAS

No	Date	Description of Activity/Session
Example	15.11.2022 Etc.	Sending series of emails to invite users Organisation of initial publicity campaign Face to face meetings to invite participants Recruitment sessions Organisation of induction trainings Demonstration of the IOs Etc.
1.		TO BE COMPLETED
2.		
3.		
No	Date	Description of Activity/Session
1.		TO BE COMPLETED
2.		
3.		

UK - Nottingham City Council.

No	Date	Description of Activity/Session
1.		TO BE COMPLETED
2.		
3.		

Bulgaria – SDRUZENIJE NA NA RABOTESHTITE S HORA S UVREZHDANIYA

No	Date	Description of Activity/Session
1.		TO BE COMPLETED
2.		
3.		

Belgium – PHOENIXKM BVBA

No	Date	Description of Activity/Session
1.		TO BE COMPLETED
2.		
3.		

Materials

For the face to face learning sessions, following materials will be made available by each partner:

- Course material
  - ppts for each IO :
    - O1 - Online Searchable Database
    - O2 - Transferred Mobile Engagement and Meltdown Measurement App
    - O4 - Handbook for Teachers and Parents
    - O5 - Pedagogical Framework for Students with Autism
  - Demonstration of the mobile application
  - Demonstration of searchable DB
- Supporting hardware
  - Laptops/PCs
  - Smart phones/tablets

To prepare for the group piloting session participants (trainers, mentors, instructors) will have to:

- Familiarize themselves with searchable DB structure, mobile application, Handbook for Teachers and Parents and pedagogical framework
- Read through the participant handouts
- Gather feedback: at the end of the piloting iteration, trainers, instructors and trainees/interns need to complete the feedback evaluation questionnaires, these must be made available in printed format

Equipment

Partners will make following equipment available to support the piloting

	PCs: NUMBER, type, OS	Laptops: NUMBER, type, OS	Tablets: NUMBER, type, OS	Smartphones: NUMBER, type, OS
Nottingham City Council United Kingdom				
DIEYFTHYNSI DEYTEROVATHMIAS EKPAIDEYSIS N. KARDITSAS Greece				
PHOENIXKM BVBA Belgium				
SDRUZENIJE NA NA RABOTESHTITE S HORA S UVREZHDANIYA				

5 Analysis

TO BE COMPLETED AFTER COMPLETION OF PILOTING

5.1.1.1

1.1. Nottingham City Council United Kingdom.

- **Number of participants**
- **Profile of participants**
- **Involvement of trainers/instructors**
- **Profile of the trainers /instructors**
- **Induction and midterm sessions held**
- O1 - Online Searchable Database
  - **Use of** Online Searchable Database **(interface, usability, presentation of the content etc.)**
  - **Encountered problems & their troubleshooting**
  - **Frequency of required support**
  - **Content improvements (if any)**
- O2 - Transferred Mobile Engagement and Meltdown Measurement App
  - **Use of Transferred Mobile Engagement and Meltdown Measurement App (interface, usability, presentation of the content etc.)**
  - **Encountered problems & their troubleshooting**
  - **Frequency of required support**
  - **Content improvements (if any)**

5.1.1.2

- O4 - Handbook for Teachers and Parents
  - **Use of** Handbook for Teachers and Parents **(interface, usability, presentation of the content etc.)**
  - **Encountered problems & their troubleshooting**
  - **Frequency of required support**
  - **Content improvements (if any)**

5.1.1.3

- O5 - Pedagogical Framework for Students with Autism
  - **Use of Pedagogical Framework for Students with Autism (interface, usability, presentation of the content etc.)**
  - **Encountered problems & their troubleshooting**
  - **Frequency of required support**
  - **Content improvements (if any)**

5.1.1.4

5.1.1.5

5.1.1.6

1.2. DIEYFTHYNSI DEYTEROVATHMIAS EKPAIDEYSIS N. KARDITSAS Greece

5.1.1.7

1.3. PHOENIXKM BVBA Belgium

1.4. SDRUZENIJE NA NA RABOTESHTITE S HORA S UVREZHDANIYA

6 Findings

TO BE COMPLETED AFTER COMPLETION OF PILOTING

1.5. Nottingham City Council United Kingdom.

1.6. DIEYFTHYNSI DEYTEROVATHMIAS EKPAIDEYSIS N. KARDITSAS Greece

1.7. PHOENIXKM BVBA Belgium

1.8. SDRUZENIJE NA NA RABOTESHTITE S HORA S UVREZHDANIYA

7 Conclusions

TO BE COMPLETED AFTER COMPLETION OF PILOTING

Annex 3: Pilot questionnaire for teachers

National coordinator (project partner): ……..

Introduction

In order to provide you with the highest possible quality training we kindly ask you to express your opinion and feedback on the AI-TOP pilot phase you have participated in. The questions are divided into four parts, each connected with the specific output:

I - O1 - Online Searchable Database

II - O2 - Transferred Mobile Engagement and Meltdown Measurement App

III - O4 - Handbook for Teachers and Parents

IV - O5 - Pedagogical Framework for Students with Autism

Your opinion will allow us to make potential modifications of the project intellectual outputs, as well as the way the pilot scheme is organised and conducted.

We believe that your comments will give us clear guidelines in terms of further improvements and amendments of AI-TOP outputs.

Who provided you with preliminary information regarding the AI-TOP project?

……

Were you satisfied with the provided guidance and information by the National Coordinator?

☐ *Yes*

☐ *No*

If No, please comment why?

……

Have National Coordinator organised an induction session(s)?

☐ *Yes*

☐ *No*

Was the time frame of the AI-TOP piloting properly planned?

☐ ***Yes*** ☐ ***No***

If the answer was "NO", please comment.

……

……

Was the level of communication with the national coordinator sufficient during the sessions?

☐ *Yes* ☐ *No*

What part of the AI-TOP piloting do you consider to be the most useful? Please comment.

……

……

……

What part of the AI-TOP piloting do you consider less useful? Please comment.

……

……

……

Did you face any problems during the AI-TOP piloting you have conducted?

☐ *Yes* ☐ *No*

If Yes, please comment:

……

……

……

PART I – Online Searchable Database

1. ***Did you get enough information and instruction how to use Online Searchable Database?***

☐ *Yes, definitely*

☐ *No*

Please comment if your answer is "No".

……

……

……

2. ***Do you consider Online Searchable Database will enable teachers/TAs/SENCOs/Parents & Carers across to view and adopt best practices in the education and behaviour management of students with ASC?***

☐ *Yes, definitely*

☐ *Yes, to some extent*

☐ *Neutral. I cannot decide on that stage.*

☐ *No*

Please comment if your answer is "No".

……

……

……

3. ***Do you consider Online Searchable Database can be used and adopted by any school, or parent/carer in the wider community as it is available as a free and open educational resource?***

☐ *Yes*

☐ *No*

If the answer is "NO", please comment.

……

……

……

PART II - Transferred Mobile Engagement and Meltdown Measurement App

4. ***Did you get enough information and instruction how to use Mobile Engagement and Meltdown Measurement App?***

☐ *Yes, definitely*

☐ *No*

Please comment if your answer is "No".

……

……

……

5. ***Does the mobile app have the potential to change/augment practice in schools supporting students with ASC?***

☐ *Yes, definitely*

☐ *Yes, to some extent*

☐ *Neutral. I cannot decide on that stage.*

☐ *No (Please comment why?)*

……

……

……

6. ***Do you consider the mobile app can be used and adopted by any school, or parent/carer in the wider community as it will be available as a free and open educational resource?***

☐ ***Yes*** ☐ ***No***

If the answer is "NO", please comment.

……

……

…

PART III - Handbook for Teachers and Parents

7. ***Did you get enough information and instruction how to use Handbook for Teachers and Parents?***

☐ *Yes, definitely*

☐ *No*

Please comment if your answer is "No".

……

……

……

8. ***Does the Handbook for Teachers and Parents improve the understanding of autism both within school, and in the wider community?***

☐ ***Yes*** ☐ ***No***

If the answer is "NO", please comment.

……

…

9. ***Does the Handbook for Teachers and Parents provide information how to create the learning environment free of triggering factors?***

☐ ***Yes*** ☐ ***No***

If the answer was "NO", please comment.

……

…

10. ***Do you consider Handbook for Teachers and Parents can be used and adopted by any school, or parent/carer in the wider community as it will be available as a free and open educational resource?***

☐ ***Yes*** ☐ ***No***

If the answer was "NO", please comment.

……

…

11. Did you get enough information and instruction how to use Pedagogical Framework for Students with Autism?

☐ *Yes, definitely*

☐ *No*

Please comment if your answer is "No".

……

……

……

12. Is individual learning adopted within the Pedagogical Framework for Students with Autism?

☐ ***Yes*** ☐ ***No***

If the answer is "NO", please comment.

……

…

13. Is social dimension adopted within the Pedagogical Framework for Students with Autism?

☐ *Yes* ☐ *No*

If the answer is "NO", please comment:

……

…

14. Is organisational dimension adopted within the Pedagogical Framework for Students with Autism?

☐ *Yes* ☐ *No*

If the answer is "NO", please comment.

……

…

15. Is Technological dimension adopted within the Pedagogical Framework for Students with Autism?

☐ *Yes* ☐ *No*

If the answer is "NO", please comment.

……

…

16. Do you think that Pedagogical Framework for Students with Autism will help schools to plan and implement AI-driven technology for use with students with ASC to provide personalisation in learning, with fewer incidents of challenging behaviour, and decreased instances of absenteeism and exclusion?

☐ *Yes* ☐ *No*

If the answer is "NO", please comment.

……

…

17. Do you think that Pedagogical Framework for Students with Autism could be transferable to other groups of school students also at risk of exclusion, including those with ADHD?

☐ *Yes* ☐ *No*

If the answer is "NO", please comment.

……

…

18. After exploring AI-TOP outputs, do you believe they can be useful for teachers, allowing them to predict meltdown events and reduce the triggering factors in the classroom?

☐ *Yes* ☐ *No*

If the answer is "NO", please comment.

……

…

Thank you for completing the questionnaire!