HEALTH ECONOMICS ANALYSIS PLAN

(HEAP)

VERSION 2.0

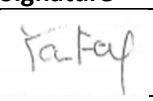
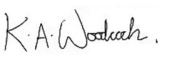
Section 1: Administrative Information

1.1 Health Economics Analysis Plan Administrative Information

Title	Three cluster randomised controlled trials in Portugal, Czechia and the United Kingdom to test the effectiveness and cost-effectiveness of an augmented social play intervention in schools to support real-world connection and sense of belonging (LINA trial)
Trial registration number	101080665
Source of funding (grant number)	UK Research and Innovation (UKRI) (10076369)
Purpose of Health Economics Analysis Plan (HEAP)	The purpose of this HEAP is to describe the analysis and reporting procedure for the health economic analyses. The analysis plan will also ensure that there is no conflict with the trial protocol and associated statistical analysis plan (SAP). It should be read in conjunction with both the trial protocol and SAP.
Trial protocol version; date	This document has been written based on information contained in the trial protocol version 0.34, dated 6/10/2025. The protocol was published in *Trials* in 2026. https://doi.org/10.1186/s13063-026-09780-7.
Trial Statistical Analysis Plan (SAP) version, date	Version 1, 01/03/2026
Trial HEAP version, date	Version 2.0, 03/11/2026
HEAP revisions	All modifications post HEAP sign-off (V 2.0) will be documented and dated in Section 1.2 HEAP revision history.
Role and responsibilities for HEAP development	This HEAP was developed by Hiro Farabi and Yan Feng, with inputs from the ASP Belong trial team including investigators, trial statistician, and trial manager, to ensure alignment with the trial protocol and SAP.

APPROVALS

The following people have reviewed the Health Economics Analysis Plan and are in agreement with the contents.

Role	**Name**	**Signature**	**Date**
Senior Health Economist	Dr Yan Feng		3nd November 2026
Chief Investigator	Professor Kate Woodcock		2nd November 2026

1.2 HEAP revision history

Updated HEAP version no	Protocol version	Section number changed	Description of, and reason for, change	Individual making the change	Date changed

Section 2: Trial Introduction & Background

2.1 Trial background and rationale

Background

Poor mental health and social isolation are increasing among young people (Hards et al., 2022). Belonging—feeling connected to and accepted by others through supportive interpersonal relationships has been shown to be an important factor in improving mental health and overcoming loneliness in adolescent populations (Eugene, 2021; Arslan, 2021). A greater sense of school belonging has been associated with a wide array of personal and social benefits including increased psychological wellbeing (Allen et al., 2018) and reduced instances of school violence, truancy, mental illness and bullying (Demanet & Van Houtte, 2012; Van Ryzin et al., 2009; Wike & Fraser, 2009).

There is, however, a lack of evidence-based interventions addressing belonging, particularly in schools, where socialisation plays a distinct and key role (Štremfel et al., 2024). Evidence-based school interventions could therefore be implemented to promote belonging, making use of an opportunistic target and potentially improving outcomes for adolescents (Allen et al., 2022). Digital technologies offer enormous potential for adolescent health promotion and management (Rose et al., 2017; Raeside et al., 2024). The ASP-Belong programme of research has developed Lina, a novel intervention whose feasibility has been established through a proof-of-concept prototype (Mittmann et al., 2022; Krammer et al., 2026). Lina uses smartphones to deliver an in person group experience, in a classroom, that combines immersive storytelling, augmented reality, collaborative gameplay and evidence-based psychotherapeutic techniques to strengthen sense of belonging within the classroom. Lina is the first full-scale version of a new intervention format—Augmented Social Play—which shares the same key ingredients but can be abstracted to different in-person group settings. Lina is a multi-session intervention that is delivered within the context of routine school lessons.

Rationale

While feasibility has been evidenced through previous work, the effectiveness of the intervention is yet to be established. The current trial is therefore the next step in developing Lina and demonstrating its effectiveness on a variety of wellbeing and mental health outcomes, but primarily on sense of belonging. The trial and embedded implementation evaluation will give definitive answers as to how effective this novel intervention is across three national contexts. It will also produce understanding about the best ways to implement the intervention into routine school activities across a number of different contexts, and about young people's lived experiences of Lina, with a particular focus on those who face additional vulnerabilities to poor mental health.

2.2 Aim of the trial

The trial aims to evaluate the effectiveness and cost-effectiveness of the ASP#1 programme (called LINA) in improving children's sense of belonging within a classroom environment in Portugal, Czechia and the UK, in comparison with usual lessons.

2.3 Objectives of the trial

The primary objective of the trial is to assess the effectiveness of the LINA in improving children's sense of belonging within a classroom environment in Portugal, Czechia and the UK.

Secondary objectives of the trial are:

- To test the impact of LINA on improving young people's mental health and wellbeing (more broadly and, specifically, in terms of social anxiety and depression).
- To test the impact of LINA on other secondary outcomes including social awareness, loneliness and young people's stigmatising beliefs.
- To collect the costs of delivering the intervention in comparison to routine school costs and conduct a comprehensive economic evaluation to establish whether LINA presents good value for money.

2.4 Trial population

Schools will be included as 'trial schools' if they:

- are a school in the UK with grade 8 students (aged 12–13)
- are a school in Portugal with grade 8 and 9 students (aged 12–15)
- are a school in Czech with grade 7 students (aged 12–13)
- agree to support the delivery of the LINA intervention as part of routine school activities in the 2025/26 academic year
- agree to the process of randomisation, with the understanding that classes which are randomly allocated to the control group will have to wait until the 2026/27 school year to implement the LINA intervention

Individual young people will be included in the trial if:

- they are 12-13 years old in the UK
- they are 12–15 years old in Portugal
- they are 12–13 years old or are classes with 12–13 years old in Czech Republic
- they are part of a class with similarly aged students
- they are assent to the collection of self-reported questionnaire data at key timepoints through the trial (baseline, 8–10 weeks post baseline, and 6 months follow-up)
- they have a parent/legal guardian who has provided written informed consent for collection of the young person's personal data (only in CZ)

2.5 Trial intervention and the comparator

- Intervention: The intervention under investigation, LINA, is a newly developed software designed to enhance students' sense of social belonging through a blended approach of interactive gameplay facilitated by smartphones in a classroom setting. All necessary equipment, including smartphones, routers, headphones, and markers will be provided by the trial team to the class. The intervention is primarily user-driven but will be guided by the classroom teacher. Additionally, a researcher will be present during every session to make observational notes and support usage, where required. The intervention consists of six sessions called 'episodes'. Four of these episodes will be delivered on an individual smartphone provided to participants, while two will be 'analogue episodes.' These analogue episodes will be structured, interactive classroom sessions designed to enhance the sense of belonging and embed the psychotherapeutic principles inherent in the intervention.

- Comparator: Control classes will engage in standard school activities/routine lessons based on the established local curriculum as normal and will be provided the intervention in the beginning of the next school calendar year.

2.6 Trial design

The design of the study is a cluster randomised, parallel group controlled, school-based trial in three countries. Three separate trials will be conducted concurrently in Portugal, Czechia and the UK. Overall, these three parallel trials will employ the same design, although there will be some differences to accommodate local contexts where these differences are planned, they are highlighted in the protocol (Malhotra et al., 2026).

The intervention provided (i.e., LINA) will replace usual lessons within the school term for a period of six lessons and will be facilitated by a teacher. Outcome data will be collected at baseline and immediately following intervention completion (8–10 weeks post baseline), and at 6 months follow up.

Trial data will be analysed separately in the first instance (i.e., country specific analysis) but will be later pooled to look for overall patterns in the data, particularly for the primary outcome (i.e., class belonging). Pooled data analysis will seek to determine if trial findings are replicated across different European national contexts, and to provide a larger, more varied sample for analysis of effectiveness.

2.7 Trial start and end dates

Trial started on the 22nd September 2025, aim to complete enrolment/recruitment by the 30th January 2026, and the trial will be concluded by 31st December 2026.

Section 3: Economic Approach

3.1 Aims of economic evaluation

The primary aim of the economic evaluation of the ASP BELONG trial is to assess the cost- effectiveness of LINA compared to routine lessons for improving children's sense of belonging within a classroom environment among school children in Portugal, Czechia and the UK.

3.2 Objectives of economic evaluation

- To compare the costs and outcomes between participants in the intervention & control arms.
- To assess the cost-effectiveness of the LINA programme compared to routine school lessons.

3.3 Overview of economic analysis

- The economic analysis will be conducted alongside the three country specific trials.
- For trials in Portugal and Czechia, descriptive analysis on the available costs and/or outcomes data will be performed.
- For the UK trial, a full economic evaluation including cost-effectiveness and cost-utility analyses will be undertaken if trial data allows for such evaluation (Plan A). If trial data does not allow for full economic evaluation, descriptive analyse on the available costs and/or outcomes data will be performed like for Portugal and Czechia trials data (Plan B).

3.4 Jurisdiction

The trial is conducted within the school settings in Portugal, Czechia, and the UK.

3.5 Perspective

The economic evaluation will be conducted from a school perspective.

3.6 Time horizon

The primary economic evaluation will focus on the period from point of randomisation until 6 months follow up. We will run sensitivity analyses using two different time horizons, i.e. (1) from randomisation until the end of the intervention period (i.e. 8-10 weeks post baseline) and, (2) from baseline until the 6-month follow up.

Section 4: Economic Data Collection and Management

4.1 Identification of resource use

Resource use data will be collected alongside the study, at baseline, post intervention and 6-month follow-up, to inform the health economic assessment. It includes teacher time for preparation and delivery, teacher time for additional student support and behaviour management, support from other professionals, teacher productivity loss due to sickness absence, and LINA-specific equipment.

4.2 Measure of resource use

In the UK and Portugal, the Health Economics Inventory Forms that were designed specifically for ASP-Belong trial will be used to collect quantity of resource use. It includes items 1–5 detailed below. In Czechia, the shortened version of the Health Economics Inventory Form, including items 1, 4, and 5, will be used. The data collection will be supplemented by trial log forms and information provided by the research team, where required. Equipment-related resource use (item 6) will be collected in all three countries using the LINA Equipment Form. Where individual-level data are required, including time spent providing mental health support during routine lessons or LINA sessions and individual support for disruptive behaviour, these will be extracted from school records.

1. **Resource use data for delivering the LINA intervention and routine lessons:** For both LINA intervention and routine lessons, we will collect the preparation time, teaching delivery time, and number of sessions/lessons delivered. For the LINA intervention, resource-use data will be collected for the intervention group only, covering the six LINA sessions/episodes. For routine lessons, resource use will be assessed at baseline and 6-month follow-up for the intervention group, and at baseline, 8-10 weeks post-baseline, and 6-month follow-up for the control group.
2. **Resource use data on teachers' additional support to students:** For the intervention group, data on additional support related to LINA will cover the six LINA sessions/episodes, while support related to routine lessons will be assessed at baseline and 6-month follow-up. For the control group, data on additional support related to routine lessons will be collected at baseline, immediately after the intervention (8–10 weeks post-baseline), and at 6-month follow-up. This will include the number of students requiring additional support, the time spent providing this support, and, specifically, the time spent addressing students' mental health issues.
3. **Resource use data on students' disruptive behaviour management:** For both the intervention and control groups, data on disruptive behaviour management will be collected at baseline, immediately after intervention (8–10 weeks post-baseline), and at the 6-month follow-up.
4. **Support from other professionals for LINA/routine lesson delivery**: For routine lessons, data on time spent by other professionals will be collected at baseline, immediately after the intervention (8–10 weeks post-baseline), and at 6-month follow-up for the control group, and at baseline and 6-month follow-up for the intervention group. For LINA delivery, this data will be collected at 8–10 weeks post-baseline for the intervention group.
5. **Data on productivity loss due to teacher sickness absence** will be collected at baseline, immediately after intervention (8-10 weeks post baseline) and 6-month follow-up for both intervention and control group. Teachers will report the duration of sickness absence during the specified recall period.

6. **Data on resources and equipment required to deliver the LINA,** including the quantity of equipment purchased, as well as quantity of equipment lost, damaged, or requiring repair or replacement, will be collected in all three countries using the LINA Equipment Log Form designed by the trial health economists.

It is possible that some schools may not be able to collect their 6-month follow-up data within the 2025/26 school year as planned. In this case, data will be collected at the actual time of follow-up, for example at 5 months. The 6-month HE Inventory Form has been adjusted to accommodate variation in the timing of follow-up data collection. Respondents will be made aware of the actual recall period, and the form will capture the length of time between the post-intervention assessment and the follow-up data collection, allowing respondents to report resource use for the appropriate recall period.

4.3 Valuation of resource use

The cost of each resource-use item will be estimated by multiplying the quantity of resource use, as outlined in Section 4.2, by its corresponding unit cost (see Appendix Table 1). Costs will be calculated and presented at the individual-student and time-point levels.

4.4 Identification of outcomes

The primary outcome measure in the economic evaluation is Quality Adjusted Life Years (QALYs), derived from CHU-9D data (Stevens, 2012). Secondary outcome measures include children's QALYs, derived from the EQ-5D-Y-3L data (Wille et al. 2010) and classroom climate, measured using the Delaware School Climate Survey – Student (DSCS-S) (Bear et al., 2011).

Data for all three outcome measures will be collected from each student via the electronic case report form (e-CRF) at baseline, post-intervention, and 6-month follow-up.

4.5 Measurement of outcomes

CHU-9D is a generic instrument used to measure health-related quality of life in children and adolescents. It assesses a child's health across nine dimensions: worried, sad, pain, tired, annoyed, schoolwork/homework, sleep, daily routine, and ability to join in activities. Each dimension has five levels of severity: 1 = no problems, 2 = slight problems, 3 = moderate problems, 4 = severe problems, and 5 = extreme problems or unable to. A child's health state is represented by a 9-digit code, with each digit corresponding to one dimension in the order listed above. For example, a health state of 211111111 indicates that the child has a slight problem with feeling worried and no problems in the other eight dimensions (Stevens, 2012).

The **EQ-5D-Y-3L** is a child friendly version adapted from EQ-5D-3L instrument for measuring general health related quality of life. It consists of five dimensions with appropriate age wording: walking about (mobility), looking after myself (self-care), doing usual activities (usual activities), having pain or discomfort (pain/ discomfort), and feeling worried, sad, or unhappy (anxiety/ depression). Each dimension has three levels of severity: (1) no problems/no pain or discomfort/not worried, sad, or unhappy; (2) some problems/some pain or discomfort/a bit worried, sad, or unhappy; and (3) a lot of problems/a lot of pain or discomfort/very worried, sad, or unhappy (Wille et al. 2010).

We will use the **Delaware School Climate Survey – Student** (DSCS-S, 23-item version), a validated instrument designed to assess students' perceptions of classroom and school. DSCS-S is the primary outcome measure for the trial's effectiveness evaluation. The 23 items focus on five core dimensions: teacher–student relations, student–student relations, fairness of rules, school/class safety, and liking of school/class. Each item is rated on a four-point Likert scale (1 = Disagree a lot, 2 = Disagree, 3 = Agree, 4 = Agree a lot), with one negatively worded item reverse-coded. Items within each subscale will be summed to calculate subscale scores, and all 23 items will be summed to generate a total DSCS-S score, with higher scores indicating a more positive classroom climate (Bear et al. 2011).

4.6 Valuations of outcomes

For the **CHU-9D**, we will apply the UK preference weights developed by Stevens (2012) to convert each child's 9-digit health state into a utility value. Each utility score reflects societal preferences for different child health states, anchored on a scale where 1 represents full health, 0 represents dead, and some states can have negative values for health states considered worse than dead. Using the utility values calculated at randomisation, post intervention and 6-month follow-up, we will estimate QALY for each participant by applying the area under the curve method, assuming linear interpolation between two neighbouring time points (Brazier et al., 2017). If there is one or more CHU9D item missing the CHU9D utility will be treated as a missing value.

For the EQ-5D-Y-3L, country-specific preference weights will be used where available. As EQ-5D-Y-3L value sets are not currently available for the UK, Portugal, or Czechia, proxy value sets will be used. The Australian value set will be used for the UK (Pan et al., 2025), the Spanish value set for Portugal (Ramos-Goñi et al., 2022), and the Hungarian value set for Czechia (Rencz et al., 2022), based on the availability of published EQ-5D-Y-3L value sets and their suitability as proxies for the respective countries. Each child's five-dimension EQ-5D-Y-3L health state will be converted into a utility value using the relevant value set. The Australian value set produces utility values ranging from 0.142 to 1 and does not produce negative values. In contrast, the Spanish and Hungarian value sets allow negative utility values for health states valued as worse than dead. QALYs for each participant will be estimated using the area-under-the-curve method based on utility values at randomisation, post intervention, and 6-month follow-ups. Where one or more EQ-5D-Y-3L dimensions are missing, the corresponding health state will be treated as missing.

For **DSCS-S** the 23 item scores will be summed to generate a total DSCS-S score, with higher scores indicating a more positive classroom climate and stronger sense of school belonging. Negatively worded items will be reverse coded prior to scoring. Where one or more DSCS-S items are missing, the corresponding DSCS-S score will be treated as missing.

4.7 Statistical software use for health economic analysis

The statistical analysis will be performed in STATA/MP 19 unless otherwise specified.

Section 5: Economic Data Analysis

5.1 Analysis population

Economic analyses will be conducted under the intention-to-treat principle, including all randomised children and analysing them according to the treatment group to which they were randomised.

5.2 Timing of analyses

The primary evaluation will focus on the period from randomisation until the end of the 6-month follow-up. We will also conduct sensitivity analyses using two different time horizons: 1) from randomisation until the end of the intervention, and 2) from baseline until the end of the 6-month follow-up.

5.3 Discount rates for costs and outcomes

Considering the duration of the analysis, discounting of costs and outcomes will not be applied.

5.4 Cost-effectiveness threshold(s)

For the United Kingdom, we will adopt the NICE-recommended willingness-to-pay (WTP) threshold of £20,000–£30,000 per QALY for the cost-effectiveness analysis (NICE, 2013). A full cost-effectiveness analysis will only be undertaken for the UK trial, subject to the availability of the required cost data items presented in Sections 4.1–4.3.

5.5 Statistical decision rule(s)

A significance level of 5% ($p < 0.05$) will be used to define statistical significance.

5.6 Analysis of resource use

Resource use for delivering the LINA intervention and routine lessons, school support services, disruptive behaviour management and equipment at 6-month follow-up will be analysed. For individual student level data, descriptive statistics, including mean, minimum value, maximum value, and standard deviation for each resource-use item by trial arm, will be reported separately for each country **(Table 2)**. For resource-use items collected at class or teacher level, the amounts will be allocated across students within each class, where appropriate, to estimate resource use per student. Resource use at baseline and 8-10 weeks post baseline are presented in **Appendices 3–4**, respectively.

5.7 Analysis of costs

Teacher-level and student-level costs (i.e., the average cost per student within each class) over the 6-month follow-up period (covering the 6 months after baseline) will be reported separately for each country in **Table 3**. Costs for the baseline and 8–10 weeks post-baseline periods will also be presented separately for each country in **Appendices 5_6**. For each country, costs will be reported in the relevant local currency using the same cost categories described in the resource-use analysis. The mean costs between the two trial arms (for each resource item and the overall resource use) will be compared using t-test. 95% Confidence Intervals (CI) will be obtained using bootstrap method with 1000 replications.

5.8 Analysis of outcomes

CHU-9D utility, EQ-5D-Y-3L utility, DSCS-S scores, QALYs derived from CHU-9D and EQ-5D-Y-3L, will be analysed at the country at baseline, 8-10 weeks post baseline and 6-month follow-up and compared between the two trial arms using t-tests with bootstrap 95% confidence intervals **(see Table 4)**.

5.9 Data cleaning for analysis

Health Economics team will perform initial data cleaning on the trial data. After database lock, the Health Economics team will carry out data linkage, data cleaning, and data analysis within QMUL's secure data environment (safe haven).

5.10 Missing data

The planned analyses from 5.10 to 5.14 only apply to data analysis for the UK trial, when the available data is sufficient to support full economic evaluation. The analyses will not apply to Portugal and Czechia trials data.

Missing values in costs and CHU-9D utility data will be addressed using multiple imputation, assuming that the data are Missing at Random (MAR). The imputation model will include covariates from the analysis model (e.g., baseline costs and CHU-9D index), as well as other baseline characteristics and variables correlated with costs and CHU-9D utility as potential predictors. Multiple imputation by chained equations will be conducted using the MI package in Stata, with the number of imputed datasets determined by the proportion of missing data.

5.11 Cost-effectiveness analysis

Mixed-effects models will be applied to analyse individual student-level total costs (from randomisation to the 6-month follow-up) and QALYs over the same period. The models will adjust for baseline costs and baseline CHU-9D index scores and will include a random effect for class. Incremental costs (ΔCOSTs) and incremental QALYs (ΔQALYs) will be estimated from these models. The point estimate of the incremental cost-effectiveness ratio (ICER) will be calculated (**See Table 5**).

5.12 Sampling uncertainty

To report the uncertainty around the point estimate of the ICER of LINA with routine lessons, we will use bootstrap approach with 1000 replications. Bootstrap samples will be drawn separately within each trial arm, with resampling conducted at the cluster level. The results will be reported in a cost effectiveness plane (**Figure 1**). We will also present the uncertainty around the point estimate of ICER using cost-effectiveness acceptability curves (CEACs) (Van Hout et al., 1994). The probability of the LINA is cost-effective at different values of decision maker's willingness to pay (WTP) ranging from £0 to £50,000 per QALY will be reported (**Figure 2**).

5.13 Subgroup analyses

We will conduct subgroup analyses to assess whether the cost-effectiveness of LINA compared to routine lessons differ between subgroups by (1) gender (female vs. male), (2) baseline social anxiety levels (categorised as participants in the upper 25% of baseline SAS-A total scores, higher social anxiety, versus those in the remaining 75%, lower social anxiety), (3) level of adherence, comparing

participants who attended at least 4 LINA sessions, including both of the last two sessions and either Session 1 or Session 2 with the remaining participants in the intervention arm.

5.14 Sensitivity analyses

We will conduct the following sensitivity analyses using the UK trial data:

- Time horizon analyses: We will use two different time horizons in sensitivity analyses, i.e. (1) from randomisation until the end of the intervention period (8-10 weeks post baseline), (2) from baseline until the 6-month follow up.
- Alternative outcome measures: We will use the QALY derived from EQ-5D-Y-3L and the DSCS-S score as alternative health outcome measures.

Section 6: References

Malhotra, T., Qureshi, O., Barnard, A. et al. Three cluster randomised controlled trials in Portugal, Czechia and the United Kingdom to test the effectiveness and cost-effectiveness of an augmented social play intervention in schools to support real-world connection and sense of belonging (Lina trial protocol). Trials 27, 516 (2026). https://doi.org/10.1186/s13063-026-09780-7

Hards E, Loades ME, Higson-Sweeney N, Shafran R, Serafimova T, Brigden A, et al. Loneliness and mental health in children and adolescents with pre-existing mental health problems: a rapid systematic review. Br J Clin Psychol. 2022;61(2):313–34. https:// doi. org/ 10. 1111/ bjc. 12331.

Eugene DR. Connectedness to family, school, and neighborhood and adolescents' internalizing symptoms. Int J Environ Res Public Health. 2021;18(23):12602. https:// doi. org/ 10. 3390/ ijerp h1823 12602. 3.

Arslan G. School belongingness, well-being, and mental health among adolescents: exploring the role of loneliness. Aust J Psychol. 2021;73(1):70–80. https:// doi. org/ 10. 1080/ 00049 530. 2021. 19044 99.

Allen K, Kern ML, Vella-Brodrick D, Hattie J, Waters L. What schools need to know about fostering school belonging: a meta-analysis. Educ Psychol Rev. 2018;30(1):1–34. https:// doi. org/ 10. 1007/ s10648- 016- 9389-8.

Demanet J, Van Houtte M. School belonging and school misconduct: the differing role of teacher and peer attachment. J Youth Adolesc. 2012;41(4):499–514. https:// doi. org/ 10. 1007/ s10964- 011- 9674-2. 6.

Van Ryzin MJ, Gravely AA, Roseth CJ. Autonomy, belongingness, and engagement in school as contributors to adolescent psychological well-being. J Youth Adolesc. 2009;38(1):1–12. https:// doi. org/ 10. 1007/ s10964- 007- 9257-4.

Wike TL, Fraser MW. School shootings: making sense of the senseless. Aggress Violent Behav. 2009;14(3):162–9. https:// doi. org/ 10. 1016/j. avb. 2009. 01. 005.

Štremfel U, Šterman Ivančič K, Peras I. Addressing the sense of school belonging among all students? A systematic literature review. Eur J Investig Health Psychol Educ. 2024;14(11):2901–17. https:// doi. org/ 10. 3390/ ejihp e1411 0190.

Allen KA, Jamshidi N, Berger E, Reupert A, Wurf G, May F. Impact of school-based interventions for building school belonging in adolescence: a systematic review. Educ Psychol Rev. 2022;34(1):229–57. https:// doi. org/ 10. 1007/ s10648- 021- 09621-w.

Rose T, Barker M, Maria Jacob C, Morrison L, Lawrence W, Strommer S, et al. A systematic review of digital interventions for improving the diet and physical activity behaviors of adolescents. J Adolesc Health. 2017;61(6):669–77. https:// doi. org/ 10. 1016/j. jadoh ealth. 2017. 05. 024.

Raeside R, Jia SS, Todd A, Hyun K, Singleton A, Gardner LA, et al. Are digital health interventions that target lifestyle risk behaviors effective for improving mental health and wellbeing in adolescents? A systematic review with meta-analyses. Adolesc Res Rev. 2024;9(2):193–226. https:// doi. org/ 10. 1007/ s40894- 023- 00224-w.

Mittmann G, Barnard A, Krammer I, Martins D, Dias J. LINA - a social augmented reality game around mental health, supporting real-world connection and sense of belonging for early adolescents. Proc ACM Hum-Comput Interact. 2022. https:// doi. org/ 10. 1145/ 35495 05.

Krammer I, Mittmann G, Nater UM, Barnard A, Martins D, Dias J, et al. LINA: an augmented reality social game enhancing sense of belonging among classmates: an uncontrolled pre-post evaluation study. Sch Ment Health. 2026(1). https:// doi. org/ 10. 1007/ s12310- 025- 09846-y.

Kurzy.cz. (2026). Platové tabulky učitelů 2026. Available at: https://www.kurzy.cz/platy/platove-tabulky-ucitelu-2026/.

Stevens K. Valuation of the child health utility 9D index. Pharmacoeconomics. 2012;30(8):729–47. https:// doi. org/ 10. 2165/ 11599 120- 00000 0000- 00000.

Wille, N., X. Badia, G. Bonsel, K. Burström, G. Cavrini, N. Devlin, A.-C. Egmar, W. Greiner, M. Herdman, J. Jelsma, P. Kind, L. Scalone, U. Ravens-Sieberer, & the EQ-5D-Y Group (2010). "Development of the EQ-5D-Y: A child-friendly version of the EQ-5D." Quality of Life Research 19(6): 875–886.

Brazier, J., J. Ratcliffe, J. Saloman and A. Tsuchiya (2017). Measuring and valuing health benefits for economic evaluation, OXFORD university press.

Pan T, Roudijk B, Devlin N, Mulhern B, Norman R. An Australian Value Set for the EQ-5D-Y-3L. Health and Quality of Life Outcomes. 2025;23:72. doi:10.1186/s12955-025-02402-x.

Ramos-Goñi JM, Oppe M, Estévez-Carrillo A, Rivero-Arias O; IMPACT HTA HRQoL Group. Accounting for Unobservable Preference Heterogeneity and Evaluating Alternative Anchoring Approaches to Estimate Country-Specific EQ-5D-Y Value Sets: A Case Study Using Spanish Preference Data. Value in Health. 2022;25(5):835–843. doi:10.1016/j.jval.2021.10.013.

Rencz F, Ruzsa G, Bató A, Yang Z, Finch AP, Brodszky V. Value Set for the EQ-5D-Y-3L in Hungary. Pharmacoeconomics. 2022 Dec;40(Suppl 2):205-215. doi: 10.1007/s40273-022-01190-2. Epub 2022 Sep 20. PMID: 36123448; PMCID: PMC9485017..

Bear, G. G., C. Gaskins, J. Blank, & F. F. Chen (2011). "Delaware School Climate Survey–Student: Its factor structure, concurrent validity, and reliability." Journal of School Psychology 49(2): 157–174.

Kreimeier, S., D. Mott, K. Ludwig, W. Greiner, & IMPACT HTA HRQoL Group, V. Prevolnik Rupel, J. M. Ramos-Goñi (2022). "EQ-5D-Y value set for Germany." Pharmacoeconomics 40(Suppl 2): 217–229.

Haluska, M., T. Mazel, P. Chytilova, I. Stefancikova, R. Mahovská, K. Buriskova, & V. Smekal (2020). "PNS113 Cost-Effectiveness Threshold in the Czech Republic: Are ICERs Still Growing? An Updated Analysis." Value in Health 23: S660.

National Institute for Health and Care Excellence (NICE). 2013. Guide to the methods of technology appraisal, 2013. Available: https://www.nice.org.uk/process/pmg9/resources/guide-to-the-methods-of-technology-appraisal-2013-pdf-2007975843781

Van Hout, B. A., M. J. Al, G. S. Gordon and F. F. Rutten (1994). "Costs, effects and C/E-ratios alongside a clinical trial." Health economics 3(5): 309-319.

Section 7: Tables, Figures and Appendices

Table 1: Baseline characteristics by trial arm and country

Characteristic	UK Intervention	Control	Czechia Intervention	Control	Portugal Intervention	Control
Age (years)						
Mean (SD)						
Median						
IQR						
Range						
Gender, N (%)						
Female						
Male						
Non-binary						
Prefer not to answer						
Ethnic group, N (%)						
White						
Mixed / Multiple ethnic groups						
Asian / Asian British						
Black / African / Caribbean / Black British						
Other ethnic group						
Languages spoken at home, N (%)						
Native/majority language						
Other language(s)						
Prefer not to answer						
Country of birth, N (%)						
Same country of residence						

Other country						
City of birth, N (%)						
Highest parental education, N (%)						
Primary education or less						
Secondary education						
Higher vocational education						
University education						
Don't know						
Prefer not to answer						
Government financial award, N (%)						
Level 1						
Level 2						
Level 3						
One-to-one teaching assistant support, N (%)						
Yes						
No						
Don't know						
Prefer not to answer						
RTP in place, N (%)						
Yes						
No						
Previously attended a different secondary school, N (%)						
Yes						
No						
Prefer not to answer						

Table 2: Resource use in quantity at 6-month follow up by trial arm and country

Resource Use items	**UK**		**Czechia**		**Portugal**	
	Intervention Group Mean (SD) [Min, Max]	**Control Group Mean (SD) [Min, Max]**	**Intervention Group Mean (SD) [Min, Max]**	**Control Group Mean (SD) [Min, Max]**	**Intervention Group Mean (SD) [Min, Max]**	**Control Group Mean (SD) [Min, Max]**
Health Economics Inventory Form Data						
Routine lessons delivered per week (N)						
Routine lesson preparation (minutes per lesson)						
Routine lesson delivery time (minutes per lesson)						
Students receiving additional support due to routine lessons (N)						
Time spent providing additional support due to routine lessons (minutes/week)						
Time spent providing mental health-related support due to routine lessons (minutes/week)						
Classroom/group-level disruptive behaviour management (minutes/week)						
Individual student disruptive behaviour management (minutes/week)						
Teacher sickness absence (days/hours)						
Other professional support for routine lesson delivery (hours/week)						
Other professional support for student support and behaviour management (hours/week)						
School Record Data						
Individual-level routine lessons mental health-related additional support (minutes/week)						
Individual-level routine lessons disruptive behaviour management (minutes/week)						

Table 3: Cost of resource use at 6-month follow-up by trial arm and country

	UK (GB)				Czechia (CZK)				Portugal (EUR)			
Resource Use items	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**
Health Economic Inventory Form Data												
Routine lessons delivered per week												
Routine lesson preparation												
Routine lesson delivery												
Students receiving additional support due to routine lessons												
Time spent providing additional support due to routine lessons												
Time spent providing mental health-related support due to routine lessons												
Classroom/group-level disruptive behaviour management												

	UK (GB)				Czechia (CZK)				Portugal (EUR)			
Resource Use items	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**
Individual student disruptive behaviour management												
Teacher sickness absence												
Other professional support for routine lesson delivery												
Total cost												
School Record Data												
Individual-level cost of routine lessons mental health-related additional support												
Individual-level cost of routine lessons disruptive behaviour management												

Table 4: Comparison of CHU-9D, EQ-5D-Y-3L, DSCS-S and QALY by trial arm and country

Variable	UK (GB)				Czechia				Portugal			
	Intervention Group Mean (SD)	Control Group Mean (SD)	Differences No adjustment (95% CI)	P-value	Intervention Group Mean (SD)	Control Group Mean (SD)	Differences No adjustment (95% CI)	P-value	Intervention Group Mean (SD)	Control Group Mean (SD)	Differences No adjustment (95% CI)	P-value
CHU-9D utility scores												
Baseline												
Post intervention												
6-month												
QALYs derived from CHU-9D utilities												
Post intervention												
6-month												
EQ-5D-Y-3L utility scores												
Baseline												
Post intervention												
6-month												
QALYs derived from EQ-5D-Y-3L utilities												
Post intervention												
6-month												
DSCS-S Scores												
Baseline												
Post intervention												
6-month												

Table 5: Cost-effectiveness analyses for the UK trial

	Costs Differences (95% CI)	Outcomes Differences (95% CI)	ICER	Probability of CE at 20,000/QALY	Probability of CE at £30,000/QALY
Primary analysis					
Sub-groups analyses					
Gender					
Baseline social anxiety levels					
Level of adherence					
Sensitivity analyses					
Randomisation to end of treatment as time horizon					
Baseline to 6 month follow up as time horizon					
QALY derived from EQ-5D-Y-3L					
DSCS-S					

Figure 1: Cost-effectiveness plane with 1000 replications (UK trial)

Figure 2: Cost-effectiveness acceptability curve (UK trial)

Appendix 1: Unit costs for resource use

Resource	Measure	Unit Cost	Source
Teacher time	£/hour	Based on applicable salary spine point and location	UK teacher salary scale (Appendix 1a)
Teacher time	£/minute	Hourly rate ÷ 60	UK teacher salary scale (Appendix 1a)
Teacher time	CZK/hour	Based on applicable salary class and salary step	Czech Republic teacher salary table (Appendix 1b)
Teacher time	CZK/minute	Hourly rate ÷ 60	Czech Republic teacher salary table (Appendix 1b)
Psychologist time	EUR/hour		Portugal Teacher Salary Scale (Appendix 1c)
Psychologist time	EUR /minute		Portugal Teacher Salary Scale (Appendix 1c)
Headphones	£/item		LINA Equipment Log
Tablet/laptop	£/item		LINA Equipment Log
Phone	£/item		LINA Equipment Log
Router	£/item		LINA Equipment Log
Markers/pens	£/pack		LINA Equipment Log
Paper	£/ream		LINA Equipment Log
Other equipment/materials	Relevant unit		LINA Equipment Log

Appendix 1a: UK teacher salary scale

Salary point	England excluding London & Fringe	The Fringe	Outer London	Inner London
M1	£32,916	£34,398	£37,870	£40,317
M2	£34,823	£36,373	£39,851	£42,234
M3	£37,101	£38,627	£41,935	£44,238
M4	£39,556	£41,075	£44,128	£46,339
M5	£42,057	£43,545	£46,800	£48,952
M6	£45,352	£46,839	£50,474	£52,300
U1	£47,472	£48,913	£52,219	£57,632
U2	£49,232	£50,668	£54,151	£60,464
U3	£51,048	£52,490	£56,154	£62,496

Appendix 1b: Czech Republic 2026 teacher salary (CZK) table

Salary step	Experience	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Class 14	Class 15	Class 16
1	**≤2 years**	18,630	20,050	21,510	23,140	28,680	35,840	36,130	36,780	37,580	38,480	39,930	42,920	46,240
2	**≤6 years**	19,240	20,690	22,320	24,000	29,500	36,140	36,470	37,430	38,360	39,650	41,790	45,920	49,640
3	**≤12 years**	20,320	21,930	23,620	25,540	30,280	36,570	37,030	37,900	39,910	41,310	44,040	48,400	53,130
4	**≤19 years**	21,590	23,270	25,120	27,020	31,670	37,330	38,170	39,330	41,570	44,350	47,680	52,300	57,210
5	**≤27 years**	22,840	24,660	26,610	28,780	33,070	38,480	39,370	40,980	44,150	47,750	52,390	56,700	61,420
6	**≤32 years**	24,610	26,590	26,640	30,950	35,410	40,460	41,560	43,250	47,840	51,690	56,630	59,680	63,670
7	**>32 years**	25,250	27,240	29,390	31,760	36,420	41,370	42,440	44,420	48,990	52,970	57,980	61,830	66,030

Appendix 1c: Portugal Teacher Salary Scale (EUR)

Salary levels	Annual salary
11–19	EUR 13,937–19,704
20–27	EUR 19,705–25,471
28–35	EUR25,472–31,238
36–42	EUR 31,239–36,284
43–51	EUR 36,285–42,772
>52	EUR 42,773

Appendix 2: Missing in costs, and outcome measures at baseline, post intervention and 6-month follow-ups by trial arm and country

Measure	Time point	UK		Portugal		Czechia	
		Intervention N (%)	Control N (%)	Intervention N (%)	Control N (%)	Intervention N (%)	Control N (%)
LINA session preparation/planning time	Post-intervention						
LINA classroom set-up time	Post-intervention						
LINA session delivery time	Post-intervention						
Routine lesson preparation	Baseline						
	Post-intervention						
	6-month follow-up						
Students receiving additional support due to routine lessons	Baseline						
	Post-intervention						
	6-month follow-up						
Time spent providing additional support due to LINA/routine lessons	Baseline						
	Post-intervention						
	6-month follow-up						
mental health-related support due to LINA/routine lessons	Baseline						
	Post-intervention						
	6-month follow-up						
Classroom/group-level disruptive behaviour management	Baseline						
	Post-intervention						
	6-month follow-up						

Measure	Time point	UK		Portugal		Czechia	
		Intervention N (%)	Control N (%)	Intervention N (%)	Control N (%)	Intervention N (%)	Control N (%)
Individual student disruptive behaviour management	Baseline						
	Post-intervention						
	6-month follow-up						
Teacher sickness absence	Baseline						
	Post-intervention						
	6-month follow-up						
other professional support for LINA/routine lesson	Baseline						
	Post-intervention						
	6-month follow-up						
other professional support for student support and behaviour management	Baseline						
	Post-intervention						
	6-month follow-up						
Materials/equipment	Post-intervention						
CHU-9D	Baseline						
	Post-intervention						
	6-month follow-up						
EQ-5D-Y-3L	Baseline						
	Post-intervention						
	6-month follow-up						
DSCS-S	Baseline						
	Post-intervention						
	6-month follow-up						

Appendix 3: Resource use in quantity at baseline by trial arm and country

Resource Use items	**UK**		**Czechia**		**Portugal**	
	Intervention Group Mean (SD) [Min, Max]	**Control Group Mean (SD) [Min, Max]**	**Intervention Group Mean (SD) [Min, Max]**	**Control Group Mean (SD) [Min, Max]**	**Intervention Group Mean (SD) [Min, Max]**	**Control Group Mean (SD) [Min, Max]**
Health Economics Inventory Form Data						
Routine lessons delivered per week (N)						
Routine lesson preparation (minutes per lesson)						
Routine lesson delivery time (minutes per lesson)						
Students receiving additional support due to routine lessons (N)						
Time spent providing additional support due to routine lessons (minutes/week)						
Time spent providing mental health-related support due to routine lessons (minutes/week)						
Classroom/group-level disruptive behaviour management (minutes/week)						
Individual student disruptive behaviour management (minutes/week)						
Teacher sickness absence (days/hours)						
Other professional support for routine lesson delivery (hours/week)						
Other professional support for student support and behaviour management (hours/week)						
School Record Data						
Individual-level LINA sessions: mental health-related additional support (minutes/week)						
Individual-level routine lessons: disruptive behaviour management (minutes/week)						

Appendix 4: Resource use in quantity post intervention by trial arm and country

Resource Use items	UK		Czechia		Portugal	
	Intervention Group Mean (SD) [Min, Max]	Control Group Mean (SD) [Min, Max]	Intervention Group Mean (SD) [Min, Max]	Control Group Mean (SD) [Min, Max]	Intervention Group Mean (SD) [Min, Max]	Control Group Mean (SD) [Min, Max]
Health Economic Inventory Form Data						
LINA session preparation/planning time (minutes)/ Routine lesson preparation (minutes per lesson)						
LINA classroom set-up time (minutes)						
LINA session delivery time (minutes)/ Routine lesson delivery time (minutes per lesson)						
LINA sessions delivered per week/ Routine lessons delivered per week (N)						
Students receiving additional support due to LINA / routine lessons (N)						
Time spent providing additional support due to LINA/ routine lessons (minutes/week)						
Time spent providing mental health-related support due to LINA/ routine lessons (minutes/week)						
Time spent providing additional support due to LINA / routine lessons (minutes/week)						
Classroom/group-level disruptive behaviour management (minutes/week)						
Individual student disruptive behaviour management (minutes/week)						
Teacher sickness absence (days/hours)						
Other professional support for LINA/routine lesson delivery (hours/week)						
Other professional support for student support and behaviour management (hours/week)						

Resource Use items	**UK**		**Czechia**		**Portugal**	
	Intervention Group Mean (SD) [Min, Max]	**Control Group Mean (SD) [Min, Max]**	**Intervention Group Mean (SD) [Min, Max]**	**Control Group Mean (SD) [Min, Max]**	**Intervention Group Mean (SD) [Min, Max]**	**Control Group Mean (SD) [Min, Max]**
Materials/equipment						
Phone (N)						
Smartphone (N)						
Other equipment (N)						
School Record Data						
Individual-level LINA sessions /routine lessons: mental health-related additional support (minutes/week)						
Individual-level LINA sessions/routine lessons: disruptive behaviour management (minutes/week)						

Appendix 5: Cost of Resource use at baseline by trial arm and country

	UK (GB)				Czechia (CZK)				Portugal (EUR)			
Resource Use items	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**
Health Economics Inventory Form Data												
Routine lessons delivered per week												
Routine lesson preparation												
Routine lesson delivery												
Students receiving additional support due to routine lessons												
Time spent providing additional support due to routine lessons												
Time spent providing mental health-related support due to routine lessons												
Classroom/group-level disruptive behaviour management												
Individual student disruptive behaviour management												
Teacher sickness absence												

	UK (GB)				Czechia (CZK)				Portugal (EUR)			
Resource Use items	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**
Other professional support for routine lesson delivery												
Other professional support for student support and behaviour management												
Total cost												
School Record Data												
Individual-level of routine lessons mental health-related additional support												
Individual-level of routine lessons disruptive behaviour management												

Appendix 6: Cost of Resource use post intervention by trial arm and country

	UK (GB)				Czechia (CZK)				Portugal (EUR)			
Resource Use items	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**
Health Economics Inventory Form Data												
LINA session preparation/planning/ Routine lesson preparation												
LINA classroom set-up												
LINA session delivery / Routine lesson delivery												
LINA sessions delivered per week/ Routine lessons delivered per week												
Students receiving additional support due to LINA / routine lessons												
Time spent providing additional support due to LINA/ routine lessons												
Time spent providing mental health-related support due to LINA/ routine lessons												

	UK (GB)				Czechia (CZK)				Portugal (EUR)			
Resource Use items	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**
Time spent providing additional support due to LINA / routine lessons												
Classroom/group-level disruptive behaviour management												
Individual student disruptive behaviour management												
Teacher sickness absence												
Other professional support for LINA/routine lesson delivery												
Other professional support for student support and behaviour management												
Materials/equipment												
Phone												
Smartphone												
Other equipment												
Total cost												
School Record Data												
Individual-level LINA sessions /routine lessons: mental												

	UK (GB)				Czechia (CZK)				Portugal (EUR)			
Resource Use items	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**	**Intervention Group Mean (SD)**	**Control Group Mean (SD)**	**Differences No adjustment (95% CI)**	**P-value**
health-related additional support												
Individual-level LINA sessions/routine lessons: disruptive behaviour management												