Statistical analysis of educational outcomes among Big Noise Raploch participants

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November 2022

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Acknowledgements

The author would like to begin by thanking Lynn Cavanagh of Stirling Council for her significant support in linking datasets and advising on educational data. Recognition also goes to Dr Carolyne McDaid and Shirley Keane, also of Stirling Council, for their guidance in establishing appropriate data sharing arrangements. The contribution of Robert Heggie, of University of Glasgow, for his input on the statistical analyses presented in this report is also acknowledged.

Catriona Snodin (formerly of Sistema Scotland) is also praised for her efforts in supporting data quality and linkage. Thanks also goes to Nicola Killean and David Sinclair from Sistema Scotland for their ongoing support and cooperation with this evaluation. Gratitude goes to the children and young people who participate in Big Noise, as well as their parents and guardians who have taken the time to be involved in this evaluation since 2013.

Appreciation also goes to members, past and present, of the Sistema Scotland Evaluation Advisory Group (EAG). Specific recognition goes to Antony Clark (Audit Scotland, chair of the EAG) for his continued commitment, support and leadership. Recognition goes to Jennie Coyle of the Glasgow Centre for Population Health for her significant support in finalising this report and previous Big Noise evaluation outputs. Finally, thanks must also go to Professor Carol Tannahill OBE (former Director of GCPH) for her support and encouragement in establishing this long-term and expansive evaluation.

This report should be cited as:

Harkins C. *Statistical analysis of educational outcomes among Big Noise Raploch participants.* Glasgow; GCPH: 2022.

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Key points

- Overall, we report that the findings of this statistical analysis examining the impacts of Big Noise participation on educational outcomes are positive.
- Almost all Big Noise participants achieved a positive post-school destination (98%) compared with 84% of non-participants of a similar sociodemographic background.
- This finding was statistically significant, despite the Big Noise cohort having twice the rate of pupils living in the most deprived SIMD decile compared to non-participants.
- In particular, Big Noise participants are more likely to secure employment upon leaving school and are less likely to be unemployed compared to non-participants.
- Educational attainment tariff scores reflect the level of pupil qualifications achieved in school. This analysis is more complex, however the findings do support a degree of positive impact due to Big Noise participation.
- The mean educational attainment tariff score was lower among Big Noise participants group (506), compared with non-participants (525).
- However, when the analysis is adjusted to account for sociodemographic variances between the two cohorts, the findings support that Big Noise participation leads to a positive impact on attainment tariff scores, although this finding is not statistically significant.
- These analyses focus on just one of seven impact pathways identified over the first phase of this extensive evaluation. Therefore, the findings presented are not a definitive assessment of programme impacts or effectiveness.
- The statistical findings presented in this report complement qualitative insights reported during the first phase of this evaluation. In particular, musicians in Raploch have been observed as keenly supporting participants to achieve a positive post-school destination.
- Repeating this analysis in the near future with a larger sample size of Big Noise participants will increase the accuracy and statistical significance of the findings, particularly within the assessment of impacts to attainment tariff scores.
- The analyses presented in this report are consistent with the wider evaluation findings which indicate that Big Noise has preventative impacts: promoting education, wellbeing, healthy behaviours, positive choices and a range of opportunities across the school years.

Introduction

Sistema Scotland is a charity "committed to improving lives and strengthening communities through music and nurturing relationships"[1]. Through its Big Noise programme, Sistema Scotland believes that children from disadvantaged backgrounds can gain significant social and life skills by playing in a long-term, intensive, immersive music education programme based on the symphony orchestra[2]. The design of the Big Noise programme enables musicians to form trusted, supportive, and nurturing relationships with participants over several years. Musicians adopt the roles of educators, role models and mentors, encouraging the pupils involved to make positive and aspirational choices at all stages of their development[3]. The interaction between Big Noise musicians and the children and young people taking part is special[3].

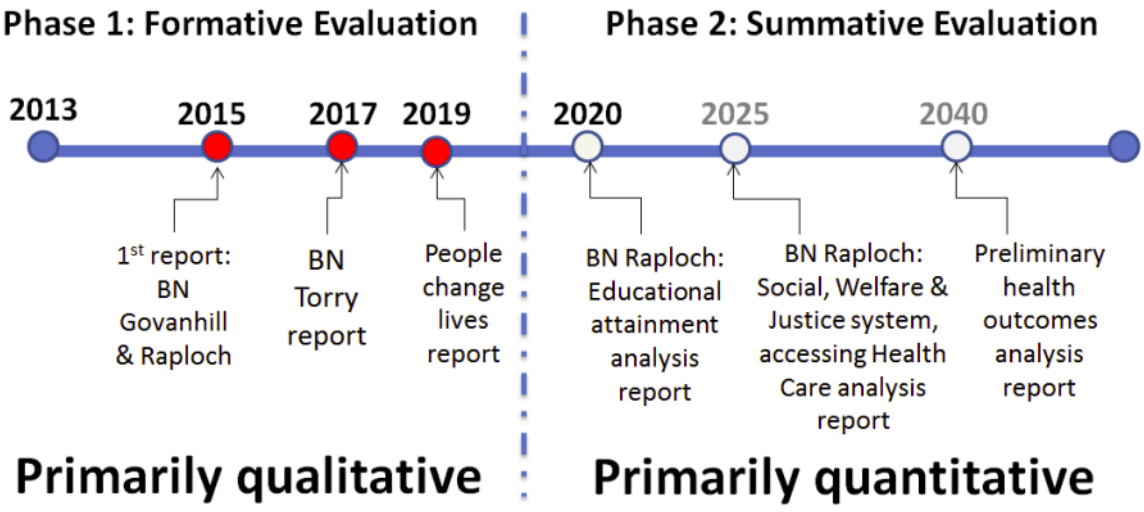
Inspired by the Venezuelan El Sistema model[4], Sistema Scotland uses collective music-making to foster wellbeing, confidence, pride and ambition among the children and young people taking part. Big Noise also aims to be a community beacon, a positive and aspirational focal point, a social intervention which dovetails with other regeneration efforts, bringing families and wider community members together in regular local concerts and events[5].

Since 2013 the Glasgow Centre for Population Health (GCPH) has been evaluating Sistema Scotland's Big Noise programme[6]. The GCPH evaluation has been designed in such a way as to avoid the methodological weaknesses seen in other studies in this field[6].

The GCPH evaluation methodology will track the impacts of Big Noise on participants as they transition into adulthood[6]. The evaluation has two phases – Phase 1, a formative evaluation has been undertaken over the period 2013-2019 and deployed a range of primarily qualitative approaches to understand how Big Noise is delivered, observe the early impacts of the programme, and to map out how these impacts are likely to unfold over time and influence later life-course outcomes. Phase 1 of the evaluation has produced three substantive reports alongside a range of briefing papers and peer reviewed publications which make clear the positive impacts observed on participants. Sistema Scotland's approach also offers important learning as to the processes involved in the delivery of effective social regeneration and early-years interventions designed to address inequalities[7].

The three substantive GCPH reports from Phase 1 of the evaluation are detailed below in Figure 1:

Figure 1: Anticipated timeline of GCPH 'life-course' evaluation of Sistema Scotland's Big Noise programme



Phase 2 marks the beginning of a summative evaluation, which has been delayed from 2020 as a result of the pandemic. Phase 2 uses quantitative analysis of life-course outcomes to assess the long-term impact of the Big Noise programme. This report details the first analysis from Phase 2 of the evaluation; focussing on the educational outcomes of Big Noise Raploch participants of school leaving age. The Raploch programme has been chosen at this stage as it is the longest established Big Noise centre with almost 90 participants at school leaving age at the time of analysis.

Future Phase 2 analysis is likely to include health outcomes of participants as well as assessment of their contact with the welfare, justice and social care systems (the timeline of such future analysis depicted in figure 1 is for illustrative purposes and may not be exact). All analysis within Phase 2 involves the outcomes for Big Noise participants being compared with those of a similar sociodemographic profile who have not participated in Big Noise.

Purpose and methods

The purpose of this report is to present the findings of a statistical analysis which attempts to quantify the contribution participation in Big Noise has made to educational outcomes. The educational outcomes observed were post-school destination (a categorical variable describing what the young person did upon leaving school) and 'cumulative insight tariff scores' (a numeric score which corresponds to the level of examination results obtained at school – the higher the score, the better the examination results obtained).[A]

In order to perform the analysis, administrative data from Big Noise Raploch, which detailed Big Noise participants, was linked to educational outcome data held by Stirling Council. In total, data relating to 89 Big Noise participants who left school by summer 2019 was used in the analysis; these participants had attended at least 100 Big Noise sessions during their time at school. The statistical analysis then compared the educational outcomes described between the Big Noise participant cohort and a 'control group' of 887 other school leavers from across the wider Stirling Council area of a similar sociodemographic background, and who did not attend Big Noise. The statistical analysis in essence 'adjusts' or equivalises variances between the two groups in order to establish or 'isolate' the contribution that Big Noise participation has made to the educational outcomes of interest. This report presents a simplified account of the analyses in order to support the understanding of the findings across a range of partner agencies. Further details relating to the statistical analyses used are available on request.

Almost all individuals in the analysis were classified as white (97%), 2% were classified as minority ethnic and 1% who were 'not known'. All participants in the Big Noise programme were white. Just over one third (35%) of the population were classified as having required additional support needs (ASN). The proportion of ASN young people was higher among Big Noise participants (42%) than non-participants (35%).

The Scottish Index of Multiple Deprivation (SIMD) classifies datazones according to deprivation status using a ranking scale of 1 (most deprived) to 10 (least deprived). Raploch is classified as a disadvantaged area and all Big Noise participants resided in SIMD 1 and 2 deciles. In order to create a comparable sociodemographic population of enough size to support statistical rigour, the control group was selected to include only SIMD decile 1 or 2 school leavers from across Stirling. However, a

[A] Scottish Government. School leaver attainment and destinations. A national Statistics Publication for Scotland. Edinburgh; Scottish Government: 2021.

larger proportion of participants in the Big Noise programme were classified as SIMD 1 decile; most deprived (91%), compared with non-participants (39%).

Categorisation of post-school destination is as follows: 'Employed', 'Further Education', 'Higher Education', 'Training', 'Voluntary Work', 'Not known', 'Excluded', 'Unemployed Seeking' and 'Unemployed Not Seeking'. Statistical comparison of post-school destination between Big Noise participants and the control group was undertaken in two ways.

Firstly, the above destination categories were classified as either positive or negative. Negative destinations included 'Excluded', 'Unemployed Seeking', 'Unemployed Not Seeking', the remainder – 'Employed', 'Further Education', 'Higher Education', 'Training', 'Voluntary Work' − were classified as positive. This enabled a quick and accessible overview of destinations among participants compared to non-participants, using regression modelling to estimate the significance of any difference identified in the odds of achieving a positive destination.

Secondly, individual destination categories were compared between Big Noise participants and non-participants. These tests enabled a more detailed consideration of the impacts of Big Noise on specific post-school destinations and estimates the significance of any differences identified.

Assessment of cumulative tariff scores was undertaken using regression modelling to establish any difference between the statistical means of the two groups. Statistical tests were undertaken to establish the validity of the comparison by examining the distribution of the scores within both Big Noise participants and non-participants.

In both the analyses of post-school destination and cumulative tariff scores, 'unadjusted' and 'adjusted' models are presented. Unadjusted models are a simple comparison between Big Noise participants and non-participants. Adjusted models take into account the sociodemographic variances between the two cohorts. The findings and discussion sections make clear the importance of the adjusted statistical modelling; again, further details are available upon request.

Contextualising the findings and limitations of the study

It is vital to contextualise the findings presented in this report within what is an in-depth and longitudinal evaluation undertaken by the GCPH. Big Noise is an ambitious and intensive programme which seeks to support a broad range of social outcomes across individual participants, their families and the wider community. The impacts of the programme are complex and diffuse and uncertainty concerning the timeline of observed impacts remains; within Big Noise and across similar interventions and studies internationally[8]. Many aspects of arts-based programmes and their impacts are difficult if not impossible to capture in quantitative terms[9].

Immersion in the arts in the broadest sense and learning to play an instrument specifically are highly individualised phenomena; the impacts of which are emotive, subjective and difficult to define[10 11]. It is likely therefore that participants experience the impacts of Big Noise in different ways and at different stages in their lives[5]. The qualitative methods deployed in Phase 1 of the evaluation identified social impacts in the following seven areas: 'Boosting engagement with learning and education'; 'Developing and building life skills'; 'Securing emotional wellbeing'; 'Building social skills and networks'; 'Respite and protection'; 'Developing as a musician'; and 'Encouraging healthy behaviours'[2].

It is important to emphasise that these analyses focus on just one of the seven impact pathways identified over Phase 1 of the evaluation. Therefore, the findings presented are not a definitive quantitative assessment of programme impacts or effectiveness. Nor does the analyses account for

the individualised way in which Big Noise impacts are likely to manifest. Indeed, it is also fundamental to be clear that Big Noise aims to improve broad social outcomes within communities facing entrenched inequality and disadvantage. The programme is not funded therefore with the specific aim of enhancing educational attainment. Rather, it is our observation, based on the Phase 1 findings, that Big Noise boosts engagement with learning and education as part of the seven pathways to improved social outcomes and transforming prospects: including enhancing learning and behavioural skills such as concentration, following instructions, pride, aspiration and team working[3]. It is on this basis that we consider the investigation of Big Noise's potential impacts to educational outcomes a worthy endeavour.

The Big Noise participant sample size (89) is adequate to conduct the analysis, however the categorical analysis using regression modelling does break this sample down to smaller sub-groups. Whilst the findings are presented as 'statistically significant' (with a p-value of less than 0.05) or otherwise, the findings section details the appropriate caution required in interpreting them. Relatedly, the associated confidence intervals presented are relatively wide, implying that there is a degree of uncertainty. Future analysis with a larger sample of Big Noise participant school leavers will increase the reliability of findings.

Metrics of socioeconomic circumstances such as the SIMD used in this analysis have inherent weaknesses, such as 'ecological fallacy'[12]. In terms of these analyses, it is difficult to ascertain whether Raploch data zones (within a community which is geographically distinct from the rest of Stirling and facing entrenched, area-specific disadvantage) are comparable to other deprived data zones across Stirling[13]. Indeed, whilst this report uses terms such as 'disadvantaged' and 'deprived', we recognise that SIMD is a numeric approximation of material and life circumstances; residents within such areas may well not consider themselves as deprived and to use such labels is a crude reductionism and stigmatising[14].

Categories of post-school destination represent a snapshot in time within the school leavers' lives; reasonable assumptions are made as to whether the destination categories are positive or negative. However, this approach is likely to have limitations[15], for example: 'Higher Education' and 'Employment' are considered positive destinations, however we have no means of assessing if Higher Education is sustained and completed or if Employment is a low paid, short-term or precarious role.

Findings

Analysis of post-school destination

First, we consider the impacts of Big Noise participation on post-school destination. Almost all (98%) Big Noise participants (87 participants from a total of 89) achieved a positive post-school destination. In comparison 84% of non-participants achieved a positive post-school destination (740 from 878 total non-participants). Logistic regression was used to estimate the odds of an individual achieving a positive post-school destination following participation in the Big Noise programme[16]. The analysis confirmed that participation in Big Noise is likely to lead to a statistically significant increase in the chances of achieving a positive post-school destination.

Both 'unadjusted' and 'adjusted' analysis were undertaken. Unadjusted analysis is a simple analysis that merely considers the likelihood of a positive destination and Big Noise participation. This analysis was statistically significant, demonstrating that Big Noise participation leads to a significantly higher chance of positive post-school destination than non-participation (p-value: 0.00). The adjusted analysis was undertaken to investigate whether any of the sociodemographic variances

between Big Noise participants and non-participants may have skewed this positive result. The adjusted analysis accounted for the potential influence of ethnicity, English as a second language, ASN and SIMD decile on post-school destination. The adjusted logistic regression confirmed that Big Noise participation still significantly increased the chances of a positive post-school destination compared to non-participants (p-value: 0.00).

In both the adjusted and unadjusted analyses, the confidence intervals within which the findings are presented are relatively large. This means that whilst there is certainty as to the positive impact of Big Noise participation on post-school destination, a larger sample size of Big Noise participants will increase the accuracy of the findings in future.

Second, we examine the role of Big Noise participation on specific post-school destination categories. The below table summarises this analysis and the following text explains the findings:

Table 1: Post-school destination among participants and non-participants

Destination	All	Big Noise participants	Non-participants	p-value for difference
Employed	290 (31%)	37 (42%)	253 (30%)	**p=0.01**
Further Education	283 (30%)	30 (34%)	253 (30%)	p=0.30
Higher Education	148 (15%)	8 (9%)	140 (16%)	p=0.08
Training	89 (9%)	11 (12%)	78 (9%)	p=0.26
Voluntary Work	2 (0%)	1 (1%)	1 (0%)	**p=0.04**
Not known	9 (1%)	0 (0%)	9 (1%)	p=0.33
Unemployed Seeking	116 (12%)	2 (2%)	114 (13%)	**p=0.00**
Unemployed Not Seeking	24 (3%)	0 (0%)	24 (3%)	p=0.11
Total	***976***	***89***	***887***	***n/a***

The first finding of note in the above table is that Big Noise participants are statistically more likely to be 'Employed' (42%) after leaving school than non-participants (30%). A p-value of 0.01 is less than the 0.05 significance threshold, meaning that this finding is statistically significant. In a similar vein, only two Big Noise participants were categorised as 'Unemployed Seeking' (2%) compared to non-participants (13%); with a p-value of 0.00 this finding is statistically significant. Relatedly, there were no Big Noise participants who were categorised as 'Unemployed Not Seeking' compared to 24 (3%) among non-participants, this finding was close to being statistically significant, but the low pupil numbers involved mean that it is not significant.

Whilst a p-value of 0.04 for the 'Voluntary Work' comparison would suggest that Big Noise participants (1%) are significantly higher in this category than non-participants (0%); the small pupil

numbers involved mean that this finding should be dismissed. A noteworthy point is that non-participants have almost twice the rate (16%) of attending 'Higher Education' than Big Noise participants (9%); the p-value of 0.08 whilst not statistically significant would be described as marginal, suggesting that this finding is worthy of consideration.

Analysis of attainment tariff score

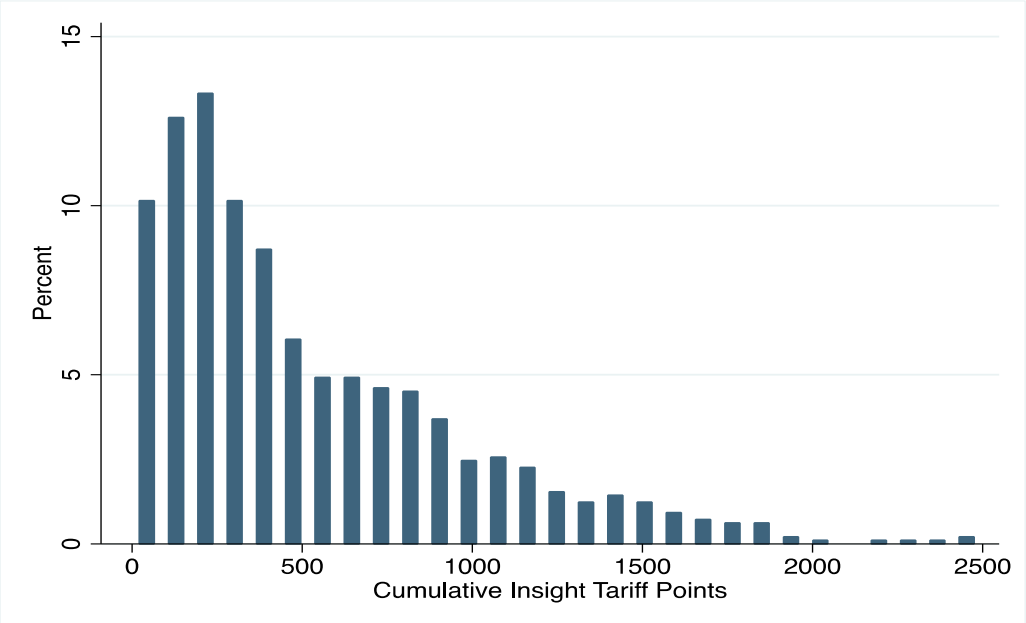
The mean cumulative attainment tariff score among all participants was 524. The median score among all participants was 375. This suggests a 'left-skewed' distribution, characterised by a small number of participants having a particularly high score. The attainment tariff scores ranged from 0 to 2,496.

The mean score was lower among the Big Noise participants group (506), compared with non-participants (525). The median score was also lower in the Big Noise participants group (348), compared with the non-participants group (377). The range of scores were less in the Big Noise participants group (24 to 1,843), compared with the non-participants group (0 to 2,496). Table 2 and Figure 2, below, summarise these data and the following text explains the analysis:

Table 2: Summary statistics of mean, median and range of cumulative tariff scores

	All	Big Noise participants	Non-participants
Mean (standard deviation)	524 (488)	506 (437)	525 (449)
Median (range)	375 (189, 764)	348 (168, 748)	377 (191, 767)
Minimum/maximum	0 - 2496	24 - 1843	0 – 2496

Figure 2: Histogram of cumulative insight tariff scores across the participant population



Given the 'skewedness' of the data, other regression models were discounted in favour of a generalised linear model. The statistical model was then used to estimate the predicted score using

marginal prediction. Marginal prediction effectively holds all else equal, apart from the predictor of interest; participation in Big Noise. Similar to the analysis of post-school destination we have undertaken both unadjusted and adjusted analyses. Within the unadjusted analysis, the mean predicted tariff attainment score yielded a slight negative impact of Big Noise participation on tariff scores. The score was 18 points lower for Big Noise participants, compared with non-participants; this result was not statistically significant.

The adjusted analysis again accounted for the potential influence of participant characteristics such as ethnicity, English as additional language, ASN, and SIMD decile. The adjusted regression found that the Big Noise programme had a small positive impact on the attainment tariff score (equating to Big Noise participants having a tariff score that was 88 points higher than non-participants), again however, this result was not statistically significant.

Further investigative analysis shows that the higher proportion of SIMD decile 1 pupils and those with ASN within the Big Noise programme has a statistically significant influence upon the lower tariff score of Big Noise participants. This explains the observed findings and when these variables are 'equivalised' within the adjusted analysis then, as stated, Big Noise participation actually has a marginal positive impact on the tariff score. Statistical modelling such as these deployed in the analysis of tariff scores requires a larger sample of Big Noise participants to yield more robust findings.

Discussion

On balance, we report that the findings of this statistical analysis of Big Noise participation on educational outcomes are positive. Almost all Big Noise participants achieved a positive post-school destination. The higher rate of positive destinations among Big Noise participants compared to non-participants was statistically significant in both unadjusted and adjusted models, despite the Big Noise cohort being more deprived and having a higher proportion of pupils with ASN. On closer inspection, Big Noise participants are statistically more likely to find employment upon leaving school and are less likely to be unemployed. Big Noise participants are less likely however to attend higher education, although this finding was marginal and was not statistically significant.

These statistical findings are consistent with and complement qualitative insights developed over five years during phase 1 of the evaluation. Qualitative findings make clear the nurturing and encouraging role Big Noise musicians adopt with participants, this trusted relationship is often forged over several years of intensive contact made possible through the specific programme design of Big Noise[3]. Through this relationship, musicians in Raploch have paid close attention to supporting participants in thinking carefully about the next chapter of their lives upon leaving school and in achieving a positive post-school destination. For example, detailed case study evidence in Raploch demonstrates Big Noise musicians helping participants in developing their curriculum vitae, their work experience and in completing job application forms.

The analysis of educational attainment tariff scores yields somewhat complex findings that whilst statistically less robust do support a degree of positive impact as a result of Big Noise participation. Educational attainment tariff scores have long been associated with SIMD status in Scotland; where more disadvantaged pupils attain lower scores. Indeed, it has been a core Scottish Government objective to address this 'attainment gap' between affluent and deprived households.[B]

[B] Scottish Government. Pupil attainment: closing the gap. Scottish Attainment Challenge 2021 to 2022.

Big Noise participants had over twice the rate of pupils residing in the most deprived SIMD decile (91%) compared to the non-participant cohort (39%); considering this sociodemographic variance in the cohorts amid the established association between SIMD and attainment tariff scores places much more importance on the 'adjusted' statistical model presented than the unadjusted comparison of mean tariff scores. When the observed SIMD variance between the groups is 'equivalised' the adjusted model predicts a positive impact of Big Noise participation on cumulative tariff scores, albeit not statistically significant in this instance.

It is important to note that improving educational outcomes is not the overarching aim of Sistema Scotland and impacts to education represent just one of seven areas of social enhancement identified during phase 1 of the evaluation. Other areas of impact will be examined using statistical methods in the future. The GCPH has developed a 'life-course' evaluation framework of Big Noise which recognises and responds to the complexities inherent in assessing the social impacts of a community-based arts intervention[16]. Such an approach means that whilst findings such as those presented in this report are relatively clear, they must be considered alongside important contextual information and amid recognition of methodological limitations. We consider these traits to be markers of research and evaluation quality and transparency.

Recommendations

- We recommend that policy designed to promote equitable outcomes and reduce inequalities should prioritise long-term, nurturing and supportive adult to child or young person mentoring relationships within disadvantaged communities. The analysis presented in this report complements the wider evaluation findings which indicate that Big Noise has preventative impacts; promoting education, wellbeing, healthy behaviours, positive choices and a range of opportunities across the early years and school years.

- Whilst difficult to measure, this evaluation also recommends greater policy consideration of the contribution arts-based interventions can make in addressing inequalities including those relating to educational outcomes. Big Noise is creative and expressive – cultivating positive relationships, aspiration, a strong work ethic and collective learning and co-operation.

- The GCPH has devised a life course evaluation, Phase 2 of which is focussed on the individual outcomes of Big Noise participants. The assessment of programme impacts on family dynamics, and in particular, on communities overall remain omissions in the evaluation design and therefore we recommend these should be considered as priority discussion points within the evaluation governance.

- We recommend that this analysis is repeated again in three to five years, at which point the sample size of Big Noise participants is likely to yield greater accuracy and statistical significance particularly in relation to the adjusted attainment tariff score analysis.

- If this analysis is to be repeated in other Big Noise sites outwith Stirling it requires data sharing protocols to be established, administrative data to be 'cleaned' and data linkage to take place. All of which requires time and resource. We recommend consideration should be given to these issues in the near future.

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