RESEARCH-ARTICLE

Practical Insights for Engaging in Charity-University Collaborations for Computing Outreach for Disadvantaged Young People

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Abstract

Computing education is often positioned as a means to promote social mobility, particularly within disadvantaged communities. While universities possess the expertise to address the computing skills gap through outreach, they often face challenges in authentically engaging with these communities. This disconnect highlights the importance of partnerships between universities and community organisations who understand local needs but may lack the expertise or resources to deliver effective computing engagements. In the following paper, we present three computing outreach case studies between a STEM-focused social mobility charity and a university in the North East of England. Drawing on the experiences of participating educators, disadvantaged young people, and their support networks, we present our findings as a practical resource for those interested in engaging in charity-university collaborations for computing outreach.

CCS Concepts

• **Social and professional topics** → Professional topics; Computing education; Informal education.

Keywords

Additional Keywords and PhrasesComputing Outreach, Computing Education, Charity-University Collaboration

1 Introduction

Concerned with creating opportunities for all members of society, social mobility is understood to be the change in social stratification, in which individual opportunities are mediated by geography, culture, support and resources. In recent years, computing skills have been positioned as a pathway for upward mobility, particularly for young people in disadvantaged communities [2]. However, these

young people are often amongst the least likely to study computing in school – disproportionately impacted by a lack of relatable role models, lower feelings of self-efficacy and limited access to resources, knowledge and supportive social networks [4].

Universities are ideally positioned to support educational development within their wider community, but often struggle to authentically engage in equitable boundary-crossing activities, particularly in areas of socio-economic disadvantage [8]. Community organisations, such as charities, are well suited to address local needs through responsive, beneficiary-driven engagements, but can find themselves limited by resources and technical expertise when it comes to delivering computing outreach. This disconnect between universities and community organisations can often result in university-driven, unidirectional engagements, that undermine the potential impact and efficacy offered by these partnerships [7, 8].

The following paper presents three computing education engagements conducted between a social mobility charity and a university in the North East of England. Exploring the experiences of disadvantaged young people, their parents/carers, and charity staff, we offer practical insights into the configuration of charity-university collaborations for computing outreach. The following case studies present charities and universities with the practical insights necessary to engage in collaborations, enhancing the educational experiences of disadvantaged young people and supporting positive social mobility in the community.

2 The Teaching Context

2.1 The Region

The North East is one the most deprived regions in England, with among the highest national levels of young people not in education, employment or training [6], perpetuating cycles of geographical disadvantage. Looking to the uptake of computing education in schools in the North East, the number of young people engaging with computer science GCSE has fallen to 12.9% (below the national average at 16.3%), with only 56.6% of schools in the North East able to provide access to a computer science GCSE [5]. These limitations in the North East exacerbate educational inequalities, placing the region's young people at a disadvantage compared to peers elsewhere in the UK [4].

2.2 The Social Mobility Charity

Established in 2019, Altitude Foundation is an independent social mobility charity based in the North East of England, with the mission to "*Create a world where all young people with a passion for*

technology are enabled to smash barriers in order to achieve a successful career" [1]. Through collaborations with industry, universities and other partners, the Foundation aims to provide disadvantaged young people aged 11-16, with a range of opportunities and supportive relationships to encourage their engagement with computing education. The charity delivers a range of school activities, workplace visits, career talks and educational workshops to support access to computing pathways. At the time of the engagements described in this paper, approximately 100 young people participated in the Altitude Foundation programme. 61% of these young people were living in the top 20% most deprived postcodes in England, with 39% eligible for Free School Meals [1] – a proxy for socioeconomic disadvantage in the UK education system. The Foundation team comprised four members, with a variety of technical and educational experience.

2.3 Newcastle University

Established in the North East of England, Newcastle University has a significant presence in the region, contributing to the local higher education landscape and engaging in various community outreach activities. The university's mission reports to be the advancement of knowledge, provision of high-quality education, and supporting the cultural and economic wellbeing of the North East region and beyond. The reported engagements involved staff members from different areas and departments of the university, none of whom were part of a formal outreach team and were driven by a variety of motivations. Participating staff included an engineering research group with a keen interest in outreach activities, a visiting researcher collecting data for a larger research project, and a PhD researcher exploring new perspectives in their research area.

3 Delivery of Engagements

In this paper, we use a reflective case study approach to examine three distinct computing education engagements between the Foundation and the university, conducted during academic year 2022/23. Data collection was drawn from publicly available data from young people, parents/carers, and anecdotal observations and reflections from the Foundation team. Member checking [3] and co-authorship was undertaken with the Foundation team, to confirm if the analysis accurately represented their experiences during these engagements, providing opportunities for additional insight and clarification.

3.1 Prosthetics Programming

The Prosthetics Programming engagement originated from a discussion between an Altitude Foundation staff member and one of the young people on their programme. This young person was interested in exploring a future career and studies regarding prosthetics, but at the point in their educational journey when they were making decisions about university options, they were unsure of next steps and the school was unable to provide subject-related advice. Leveraging previous connections with the Intelligent Sensing Lab at Newcastle University, the Foundation proposed a collaborative event to provide specialised insight into university pathways, and hands-on programming experiences for the cohort, centred around prosthetics. The Foundation would provide the logistics

of the event, including travel for the 16 attending young people, and proposed the schedule of the event to balance demonstrations with hands-on activities. The university would provide hands-on demonstrations of prosthetic systems. Together, the two groups worked on the design and delivery of a practical coding session where young people would programme educational robotic hands to put their learning into practice. This engagement proved highly successful, with young people providing feedback noting that the opportunity to get hands-on and code their own prosthetic hands was the highlight of the activity. The core challenge for educators was the timing of the event and ensuring that young people had sufficient time to engage with activities, while remaining prompt for their taxi transport home. The long-term impact of the event was exemplified by one parent's feedback, saying *"Fast forward a year, and [my son] has accepted a place at [the university] to do Mechanical Engineering,"* attributed to their event attendance.

3.2 Bots for Good

The "Bots for Good" was a two-day event between Altitude Foundation and researchers at Open Lab at Newcastle University, focusing on *"creating robotic prototypes for social good in their community"*. The topic emerged from discussions between the research group and the Foundation, with the university agreeing to host and cater, and a visiting researcher offering their expertise, with an interest in conducting research on young people's perceptions of social robotics. Altitude would provide the expertise to design and structure the event appropriately for their young people.

Across these two days, researchers guided 32 young people through ideation activities using design research materials, followed by coding activities led by the Foundation. The event culminated in a showcase where teams presented their "Bots for Good" projects to an audience of peers, educators, researchers and families. Following the event, students highlighted that engaging with robots and showing off their projects in the showcase were the most impactful elements of the event. The design of such an intervention was encapsulated by one parent expressing the challenge of accessible educational engagements for their child, saying *"[M]ost out of school activities are just not accessible to him and he doesn't want to do them, but he was very enthusiastic about this event. The provision of the food and taxi was amazing and removed any barriers to [our son] attending. This is quite honestly, the most inclusive event I have ever experienced as a parent."* Travel to the events was widely acknowledged by parents/carers as a key offering of the programme for their young people to engage.

3.3 Apps for Good

Following mutual attendance at an event, a Newcastle University researcher reached out about the potential for collaboration around approaches to teaching social perspectives in technology design. While the researcher had previously explored this approach at Higher Education, they were interested in exploring this concept with young people before they researched university. Through this conversation, it was decided that this topic might make an appropriate focus for a hackathon event, but work would need to be done to make the content accessible for young people

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Held toward the end of the Summer break, the "Apps for Good" project would focus on developing apps that would encourage community interaction with the Newcastle University campus, as a way to build better relationships between the university and a specific community identified by the teams of 18 young people. In this case, the challenge was set by the Foundation, with the researcher providing their expertise on methods for design and ideation. Focusing on ideation, data collection and early prototyping, young people demonstrated disengagement and poor behaviour, possibly due to end-of-summer fatigue and difficulty engaging with a more abstract topic. Identifying this challenge, the Foundation adapted by introducing a team-building activity at the start of day two, followed by sketch prototyping, to re-engage young people. While this helped reinvigorate their engagement with the topic, it did impact some of the scheduling of the day and some activities were rushed. Young people then worked to create a digital or paper prototype of their app, while the researcher invited young people to attend a focus group to discuss their experiences. The event culminated in a final project showcase, where parents and family members were invited to attend and celebrate their achievements. Feedback from this event was focused most only careers, with young people attending the event to learn about UX and app development, with one young person expressing an interest in exploring pathways to becoming a university lecturer.

4 Discussion

In presenting the case studies, we highlight the challenges and opportunities of charity-university collaborations in computing outreach aimed at disadvantaged young people. By examining the experiences of charity-based educators, young people and their support networks, we offer the following practical insights for engaging disadvantaged young people with computing outreach and explore ways in which charities and universities can bridge the gap between academic expertise and community needs.

4.1 Practical Insights for Engaging Disadvantaged Young People

Understanding the target audience is crucial to effective outreach. The Foundation's experience demonstrates the importance of tailoring outreach programmes to the specific needs of young people. Cultural understanding plays a significant role in support, evidenced by the Foundation's work to translate academic experiences into accessible engagements for their young people.

Designing effective outreach programmes requires a nuanced balance between educational content and engaging activities. The case studies highlight the importance of flexible engagement design and delivery. As observed in the Apps for Good project, the ability to adapt and structure content in response to participant need is essential, though care must be taken to consider its impact on educational quality. This flexibility allowed the Foundation to introduce team-building activities to re-engage young people when initial approaches proved challenging.

Overcoming barriers to participation emerged as a key theme across all engagements. Logistical challenges, particularly transportation, catering and timing of events, can impact participation

rates. Altitude Foundation's commitment to the provision of transport and catering removed significant barriers, noted by the parent who described the Bots for Good event as "*the most inclusive event I have ever experienced.*" The understanding of timing and academic calendar, particularly related to educational engagement with young people, also particularly impacted the event held during the summer holidays – attributed to fatigue. The Foundation was aware this might happen, and had prepared an alternative activity, but this might not always be considered by organisations infrequently engaging with cohorts of young people. These factors underscore the importance of addressing participation constraints for disadvantaged young people, ensuring cultural sensitivities and considering accessibility issues that may not be immediately apparent to university staff [7].

4.2 Bridging the gap: Roles of Charities and Universities

Charity contributions in this space are both multifaceted and crucial – and it is important to surface these contributions within a collaboration. In these case studies, the Foundation's expertise was supporting the translation of academic content into age-appropriate, accessible content. This ability to "bridge the gap" between academic knowledge and relatable engagement methods is a valuable asset that universities may struggle to achieve independently when working with specific subsets of the community. Moreover, charities can facilitate smoother transitions between familiar and unfamiliar contexts for their young people [7], acting as advocates for their support and engagement in novel, and potentially intimidating, environments. Charities can also offer invaluable access to research engagements with young people, though this must be carefully managed with consideration of ethical implications, particularly when working with disadvantaged populations. The Foundation's guidance in supporting the design of research engagements helped to support the research elements within the Bots for Good engagement.

University contributions centre on being a nexus for resource – including access to equipment, facilities and unique experiences. Campus visits, such as those in the Apps for Good engagement, offer young people exposure to Higher Education pathways that they might not otherwise encounter. However, the effectiveness of these visits can vary; our experiences suggest that collaborations might benefit from the structured integration of hands-on activities and campus-based engagements. Equally important is the expertise and role modelling provided by academic staff. Across the case studies, young people reported learning about new career pathways that they would have not experienced without combined university and charity support. The Prosthetics Programming engagement, exemplified how researchers can authentically inspire and support young people into STEM.

Synergies in collaboration emerge when charities and universities leverage their complementary strengths. Charities' local knowledge and community connections, combined with universities' academic expertise and resources, create a powerful platform for supporting intersectional opportunities for social mobility amongst disadvantaged communities [2, 4].

4.3 Lessons Learned and Best Practice

Several key lessons emerge from our case studies. First, the importance of aligning expectation and motivation in charity-university collaborations cannot be overstated [7]. Differing approaches can offer opportunities to collaborators, dependent on their goals, and can be adapted to suit specific circumstances. The Prosthetics engagement showcased an expertise-driven approach, allowing rapid response to young people's interest but requiring clear communication. The Apps for Good model effectively managed limited researcher availability, suggesting potential for universities with constrained outreach capacity. Bots for Good demonstrated a co-operative model, capitalising on each collaborator's strengths but requiring coordination.

Amongst all collaborations, flexibility emerged as a critical factor. Adapting to challenges was crucial to maintain quality and relevance of outreach activities, particularly with populations who struggle to engage, and remain engaged, with computing activities. Furthermore, long-term impact and sustainability should be key considerations in outreach programme design. The Prosthetics engagement's success, in inspiring one participant to pursue mechanical engineering at university, exemplifies the potential long-term effects of well-designed outreach collaborations, that could not be achieved independently.

5 Conclusion, Limitations and Future Work

Our findings point to areas for future exploration in charity-university collaborations for computing outreach. Longitudinal studies, tracking the long-term impact of these engagements on young peoples' educational and career trajectories, would provide valuable insight into the efficacy of different collaborative models and their impact on long-term social mobility. Investigating scalable approaches to overcome logistical barriers, such as transportation and scheduling conflicts, could significantly expand the impact of such outreach. Additionally, exploring innovative ways to maintain engagement between structured events could provide new opportunities for long-term engagement and impact.

While our case study approach provides a rich, contextual view of collaborations between a charity and a university, it is important to acknowledge its limitations. The geographical focus on the North East of England, as well as the specific characteristics of Altitude Foundation and their university collaborator, may limit the generalisability of our findings to other regions with different socio-economic contexts. However, as a call to action, we hope to inspire others to transfer, adopt and critique these practices, contributing to this body of practice.

In conclusion, charity-university collaborations offer a promising approach to re-engaging disadvantaged young people with computing education. By leveraging the unique strengths of each collaborator, these relationships can provide the expertise, resource and support to encourage disadvantaged young people to overcome barriers to participation, empowering their exploration of new educational and career trajectories through computing.

Acknowledgments

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