OurKidsCode: Facilitating Families to Be Creative with Computing

Nina Bresnihan[1][a], Glenn Strong[1][b], Lorraine Fisher[1][c], Richard Millwood[1][d] and Áine Lynch[2]
[1]School of Computer Science and Statistics, Trinity College Dublin, Dublin, Ireland
[2]National Parents Council (Primary), Ireland

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Abstract: OurKidsCode is a joint project between Trinity College Dublin and the Irish National Parents' Council (Primary) which aims to promote and support families' interest and activity in computing through the delivery of family creative-coding workshops at a national scale in Ireland. There is evidence that parents highly value computer science education, and are interested in supporting and encouraging their children's engagement with it. However because of their lack of knowledge and skills, they find this challenging. We present a rationale for the project, and report on the design, development and evaluation of family creative coding workshops delivered in non formal settings which engage families as computational co-creators. The evaluation of the pilot workshops show promising results for parents' attitude to learning with their families and significant increases in their confidence to do so. They also provide evidence that the workshops succeed in promoting and supporting families' interest and creative activity in computing and the learning collaboration between parent and child.

1 INTRODUCTION

OurKidsCode is a project designed to promote and encourage Science, Technology, Engineering and Mathematics (STEM) education by supporting parents in Ireland who wish to engage their children's interest and activity in computing. It seeks to strengthen the social support around a child by engaging their families and community as learning partners as they pursue pathways into computing. There is evidence that parents value computing education, and are interested in supporting and encouraging their children's engagement with it (Gallup and Google, 2015; Finn, 2014). However because of their lack of knowledge and skills they find this challenging. To address this the project proposes to design and deliver family workshops where parents and children experience the creative use of computing together. It thereby aims to increase parents' competence and confidence with digital skills and tools as they endeavour to support their children's learning. The project aims to have impact at a national scale through partnerships to deliver the workshops throughout Ireland. This paper outlines the design, development and evaluation of family workshops for creative computing.

[a] https://orcid.org/0000-0003-4381-7005
[b] https://orcid.org/0000-0003-3772-2958
[c] https://orcid.org/0000-0002-2619-4654
[d] https://orcid.org/0000-0001-8001-1989

2 RATIONALE

The importance of Computational Thinking (CT) as a 21st century skill that can promote higher order skills like problem solving, creative thinking, and logical reasoning is widely accepted (Wing, 2006). Indeed it has been argued that it is "an ability, a skillset, that every child should possess" (Voogt et al., 2015) There is common agreement that the best way to foster CT is through the learning of coding (Grover and Pea, 2013). This, along with an acknowledged skills shortage in the ICT sector, has meant that many countries have responded by updating or developing new school curricula in computing (Keane, Neil and McInerney, Clare, 2016). The Irish school system is made up of primary, and second-level education. Primary education consists of an eight year cycle: junior infants, senior infants, and first to sixth classes commencing at age four or five. Pupils normally transfer to second-level education at the age of twelve or thirteen. Computer Science was introduced as a subject

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at second-level in September 2018 and the National Council for Curriculum and Assessment (NCCA) is currently actively considering approaches to introducing the teaching of coding to all students in primary schools through its 'Coding in Primary Schools' Initiative (Millwood et al., 2018).

Internationally, there is a body of evidence that parents highly value computing education. In the US two-thirds of parents think computer science should be required learning in schools and 91% want their child to learn more computer science in the future (Gallup and Google, 2015). This desire for computing education among parents, and their willingness to support it, is also evident in Ireland with 2 in 3 believing it to be as important as mainstream subjects despite its current lack of availability in schools (Finn, 2014). However, children spend 85% of their waking time outside school, and longitudinal studies provide evidence confirming that parental involvement is strongly associated with better cognitive achievement (Desforges and Abouchaar, 2003; Harris and Goodall, 2008). Moreover, when families participate in specific programs aimed at increasing their involvement, improvements are seen in overall achievement (Shaver and Walls, 1998); reading, writing, and mathematics skills (Epstein et al., 1997; Jordan et al., 2000; Starkey and Klein, 2000); homework completion (Cancio et al., 2004); US statewide assessment scores (Sheldon, 2003); and behaviour (Kratochwill et al., 2004; Pantin et al., 2003). Parents are also key to choosing many of the non-formal learning experiences for their children (Crowley and Jacobs, 2002). Parents' influence on their children's educational choices is also crucial; 73% of Irish parents recognise themselves as the biggest influencers of subject choice and 90% of them agree that their awareness of future career opportunities is an important factor in encouraging the choice of STEM subjects. However 68% reported feeling 'moderately,' 'poorly' or 'very poorly' informed on STEM career opportunities and industry needs (Accenture, 2015).

Indeed, many parents have little experience in computing, technology or education, and struggle to facilitate the learning experiences of a child who has an interest in computing. Perceived barriers to parental involvement in education are defined by (Hornby and Blackwell, 2018) as "individual parent and family barriers; child factors; parent–teacher factors; and societal factors". Of particular concern here are parent and family barriers, with (Kong et al., 2018) emphasising the importance of parents as feedback providers and stating that their involvement and support are crucial to computing education in schools. Moreover, (Sadka and Zuckerman, 2017) argue that it is essential that we understand parents', and their children's, perceptions of computing, including coding. This is because "making activities for children often take place at informal learning environments. In this context parents may join their children for co-making activity. It has been shown that this type of activity can be facilitated by educators that serve as mentors" (Sadka and Zuckerman, 2017, p.609). Despite this, research revealed little in the way of specific programmes to address this with some notable exceptions such as MIT's Family Creative Learning programme (Roque, 2016) and (Brahms, 2014) exploration of family participation in a museum-based maker space.

Understanding the barriers to computing, and conding in a family context can help address issues of confidence and competence, providing parents a positive experience of computing, and children with the supports they need to explore and embrace the power of computing. Accordingly, one of the key recommendations of the Accenture report is that parents be supported and it explicitly recommends working with the national parents association to explore how "we create the learning and the understanding of the benefits of STEM" (Accenture, 2015, p.18). While this report focuses on second-level, our decision to target parents of primary-school children through the National Parents Council Primary (NPC), the national representative organisation for parents of children attending primary school, is based upon research which shows that that the earlier the parental involvement occurs the greater the impact (Sylva et al., 2008).

The evidence shows that parents are interested in supporting and encouraging their children's engagement with computing education. With the introduction of computing at primary and second level in Ireland, it is clear that parental involvement (e.g., being able to help a primary school student with their homework or a second-level student with career choices) is of growing importance. Clearly there is potential for parents/guardians to play a significant role in sparking and supporting interest in coding and CT. What is lacking is support for those who wish to undertake these kinds of initiatives but who feel they lack confidence, knowledge and skills. There is a strong rationale for supports for parents as they guide their children in learning skills essential for success at school as well as giving them a creative outlet for critical thinking and collaborative problem solving.

3 NEEDS ANALYSIS

We began by undertaking empirical research into our users in order to establish demand and inform resource design. To this end, two questionnaires, one for parents and the other for children, were designed to capture data regarding their computing experience, use, attitude, and availability. They also looked to discover what, if any, support children were currently receiving from their parents.

3.1 Questionnaire Design

The questionnaires took the form of mixed-methods online questionnaires containing questions and scales adapted from pre-validated instruments (Kay, 2006; Cutts et al., 2017; Hayward et al., 2002; Aesaert et al., 2015; Vannatta and Banister, 2008) as well as some project-specific questions. They contained open questions and Likert scales exploring parents' and children's confidence and competence in computing and current levels of parental involvement. The factors explored in both surveys included computing experience, computing use and availability and computing self-efficacy. The parent survey also explored what computing activities they already undertake with their children and what interest they have in these activities. Complementary questions in the child survey asked what kind of supports their parents currently give them in their computing activity.

The questionnaires were circulated in July and August 2018 through the NPC and other supporters such as the Computers in Education Society of Ireland (CESI) and the Irish Department of Rural & Community Development. They closed having been completed by 1228 parents and 405 children. In the next section we discuss the findings relevant to the workshop design.

3.2 Findings of Needs Analysis

3.2.1 Parent Questionnaire

The rationale for the project was clearly supported by the findings. Parents clearly recognise the importance of computing, with 95% of them agreeing that all children should have an opportunity to learn about computing in primary school. They also realise that they have a role to play in this and they want to actively engage with their children, with 67% agreeing that learning new things about computers that they can use with their families is important to them and 78% agreeing that they would like to spend time with their child when they are learning about computers. They have multiple motivations for this, with 84% reporting that they'd like to help their child understand what coding does. They also overwhelmingly agreed that that it is important to teach their child/children about the role computers play in society (94%) and that they would like to be able to help their child decide if they would like to be a Computer Scientist, or work in technology in the future (84%). Despite this only 15% of parents regularly plan activities in which they use computers with their children.

Quite a high number of parents, 21%, reported that they have a qualification in computing, however the level ranges from EDCL right up to PhD level. On the other hand, 68% have never tried to code with another 7% reporting that they have tried but not succeeded. When asked what they used computing devices for at home, passive or 'consuming' activities such as browsing the internet, watching videos, listening to music, playing games and shopping were each being carried out by over 70% of respondents while more creative activities such as desktop publishing, website development, media creation, coding and robotics were undertaken by less than 20%. Despite this, most reported confidence in their use of computers with 67% agreeing that they are confident in their ability to troubleshoot when problems arise and 77% that they are confident when trying to learn new things.

3.2.2 Child Questionnaire

The 405 respondents to the child questionnaire ranged in age from 5-14 representing all classes in primary school. Similarly to their parents, children mostly use computers as consumers rather than creators. Playing games is the most popular activity followed by viewing videos, listening to music, browsing the Internet and using educational apps. Only 22% report that they have engaged in coding with numbers for robotics or electronics (5%) and making websites (1.7%) even lower.

It is clear that parents are already taking a lead in their children's computing activity: they monitor usage with 94% of children saying that their parents limit their screen time and 83% saying their parents decide what activities they do on the computer. Children also turn to their parents for technical support. More interestingly, when asked where they learned about computers, while 55% reported they learned at school, this was followed very closely by the 53% who learned at home. In contrast only 17% reported learning at computer clubs or after-school classes and 20% have never learned. When asked who has helped them learn, more children identified a parent or guardian (67%) than any other category including teachers (58%), and Coderdojo or other computer-club mentors (23%). As well as parents, children also identified siblings (23%) and extended family (12%) as sources of help providing further evidence of the importance of the family in this role.

However, when asked what they did with their parents, the responses once again show a pattern of mostly passive consumption of technology. While parents spend time with their children searching for information on the Internet, listening to music or watching videos, and particularly when working on projects or presentations, they do not generally make websites, code or do robotics or electronics activities. Children like showing their parents things they make on the computer (67.6%) and generally enjoy spending time on computers with their parents.

3.3 Peer Validation

Validation is a checking process that requires the researcher to consider their role in influencing the research process (Cohen, 2002), how data sources merge and relate to one another (Anzul et al., 2003), and consider who the audiences will be (Kent, 1996). Validation from experts, and community groups who share the researchers' interests and values, can help us develop theories and strategies. Validity can be achieved by peer and community consensus; using a process which involves the pulling together of shared concepts and ways of looking at the world to support judgement on the relevance of claims. To this end, using opportunistic sampling, n = 5 domain experts (including teachers, academics, and code club mentors) were gathered to discuss the findings of the questionnaires and share their expertise. The discussion was audio recorded and written observation notes taken. They confirmed that the findings were consistent with their experiences and provided verification that the questionnaires provided reliable and valid evidence of a nationally distributed need and demand for family opportunities to learn creative computing.

3.4 Application of Needs Analysis

The Needs Analysis concluded that, while parents and children are comfortable with using computers for more passive activities, they do not have the experience to engage with more creative computing activities such as coding, media creation, or physical computing. However, they do report a good level of confidence in their ability to learn new things and have expressed a clear interest in learning with their families. This evidence supports a hypothesis that any supports developed should be collaborative in families and that families are ready and able to benefit from such interventions. In particular, they informed the project's decision to provide creative computing workshops for families designed to increase confidence and encourage self-sustaining communities of practice.

Arising from the conclusions of the Needs Analysis, the project's objectives were refined:

1. To develop, publish and promote a workshop model that will help parents/guardians who feel they lack the skills and knowledge to integrate technology into their children's learning activities.
2. To provide direct support for parents/guardians who wish to encourage children's engagement with coding and CT at an early stage of their education.
3. To encourage and enable parents/guardians to learn and develop their own involvement with creative computing by increasing their confidence and knowledge.

The following stages of the project were then defined:

1. Design the workshop and workshop supports
2. Pilot the workshop and supports across 3 schools (1 urban, 2 rural)
3. Refine workshop, develop online resources
4. Train facilitators
   (a) 21 NPC Trainers (through our partnership with the NPC).
   (b) 30 other including community workers, CoderDojo mentors and other educators.
5. Facilitators deliver the workshops nationally

Evaluation will be ongoing for all stages of the project. The sections that follow describe stages 1–3, namely the design, development, and evaluation of the workshops

4 WORKSHOP DESIGN & DEVELOPMENT

4.1 Workshop Model

The workshops follow a Constructionist design with the participants working in their families towards the creation of a meaningful tangible artefact with the aim of both introducing them to computing concepts and connecting them to each other (Kafai and Burke, 2015). The delivery is informed by theories of learning such as Social Constructivism (Ackermann, 2001) where knowledge construction is viewed as a social

Table 1: Workshop model: phases and rationales.

Phase	Description	Rationale and relevant Design Principle [DP]
Setup	The physical environment is set up to enable the rest of the workshop. The facilitator makes refreshments available to the participants, distributes materials, and helps ensure the equipment is working	Debugging issues such as wi-fi connectivity in this phase avoids interfering with the workshop activities. Meanwhile participants begin to talk casually over refreshments [DP4, DP5].
Introduction	The facilitator briefly explains the workshop model to ground the families.	This sets the scene, and helps focus the participants on the process as well as the content [DP1]
Warm-up and Ice-breaker	All participants take part in an 'unplugged' ice-breaker activity specific to the creative activity planned for the session. These activities are physical (participants stand up and move around as part of the activity)	This phase introduces the creative task, and allow families to be more at-ease with each other, thus facilitating peer learning during the next phase. [DP5, DP2]
Create	A creative technical challenge is given to the participants, forming the main part of the workshop. The challenges combine coding and 'making' activities and are designed to encourage family members to take on different roles during the completion of the challenge.	Families are encouraged to collaborate both within and between family groups, and to take on varying roles as they work on the challenges. [DP1, DP2, DP3, DP4, DP5]
Share	Families share their creations in a structured way (a tournament or showcase)	Bringing the families together at the end gives a sense of achievement and fulfillment [DP2, DP4]
Reflect	All participants sit in a circle and share what they have enjoyed and learned, encouraging discussion of future plans.	Improves the learning by offering an opportunity to say out loud what was learnt and evaluate strengths and weaknesses. Setting agenda for further work and making commitment for future engagement is a part of this phase. [DP4, DP5]

and cultural process and social interaction is crucial to the learning outcomes. Furthermore, Constructivism's student-centered approach means workshop leaders are not simply information providers; but facilitators of students' knowledge construction. This lends itself to the project's aim of participants taking ownership of their learning thereby increasing their confidence to pursue further activities.

Based on these theories, and the needs analysis, a number of design principles (DPs) for the workshops were identified:

DP1: The workshops should consist of structured creative activities leading to the collaborative making of a meaningful artefact.

DP2: The workshops should provide for creativity and playfulness, and should tap into the participants' expressed desire to use computers as creative tools.

DP3: The workshops should be collaborative within families, engaging parents and children together, supporting inter-generational learning. They must therefore provide for varying levels of interest and ability and the wide age range within one family.

DP4: The workshops should be designed to bring multiple families together, encouraging inter-family communication and support, and helping foster self-sustaining communities.

DP5: The workshops should encourage the idea of families pursuing further activity both as a family unit and/or along with other families.

In addition, the workshops are intended to be delivered throughout Ireland by NPC training staff, CoderDojo mentors, and other interested parties who will act as facilitators. The delivery is envisaged to take place in an after-school or similar context, guided by the facilitators, and a number of specific challenges related to this were identified:

- The workshops must allow for delivery by facilitators without extensive technical knowledge
- Support materials must be designed to assist facilitators, and help families solve problems with the tasks.

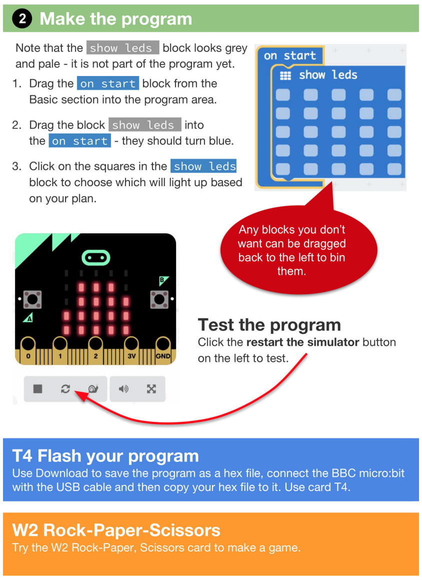

Figure 1: Example OurKidsCode Card.

- The workshops must fit within 60–90 minutes available as after-school activities
- The demands on the facilitators and the physical space suggest a maximum of 20 participants over 5–6 families.
- The workshops should be suitable for continuation in the home and the necessary materials be available.

The workshop model was designed accordingly to consist of six phases, shown in table 1.

A facilitator trained by the project team guides the families through each phase using support materials:

- The “OurKidsCode cards”, a series of A5 printed activity, support, and technical cards which provide both facilitators and participants with guidance. The cards are designed to give participants clear stepped instructions for activities along with troubleshooting advice. They also give facilitators guidelines for running the workshop and provide rationale and background information as well as ideas for follow-on activities.
- A supporting website which contains descriptions of the workshop model, and downloadable copies of the cards and provides support and encouragement for families to undertake follow-on activities.

4.2 Sample Workshop Description

The content of the first OurKidsCode workshop developed during the pilot illustrates how the model works in practice. The workshop sets families the challenge of making a wearable using the BBC micro:bit that supports the game rock-paper-scissors, adapting content from the make:code site (Microsoft, 2018).

The workshop begins with an ‘**Icebreaker**’ phase lasting roughly ten minutes in which families participate in a rock-scissors-paper tournament, long enough to ensure that all families are fully relaxed with each other. This phase of the workshop also ensures that the families are familiar with the rules of activity used in the workshop. In each OurKidsCode workshop the ‘Icebreaker’ and ‘Share’ phases are intentionally designed to reflect and support the specific content of the ‘Create’ phase.

Following the ‘Icebreaker’ phase the families move on to the ‘**Create**’ phase. This is the longest phase of the workshop, typically lasting around 45 minutes. The relevant OurKidsCode cards for the workshop help to structure the activity in this phase into smaller tasks. This phase is designed to contain both making and coding activities which can take place in parallel. As well as the aforementioned advantages that come from creating a tangible artefact, this allows family members of all ages to make a meaningful and enjoyable contribution to the workshop even if their immediate interest is not in the coding. In the rock-scissors-paper workshop the artefact is a wearable wristband containing a micro:bit which has been programmed to randomly select one of three images when shaken. Important concepts explored in the coding activity include the use of if-then constructs to represent choice, responding to events and input, and simple data representation (as randomly generated numbers are used to select images to display).

When the families complete their wristbands the ‘**Sharing**’ phase of the workshop begins. Mirroring the ‘Icebreaker’ phase, this consists of a second rock-scissors-paper tournament, this time using the wearables creating in the previous phase. This is typically a ten to fifteen minute tournament in which families are able to share and show off their creations.

Finally, the families sit together for the ‘**Reflect**’ phase in which they share their experiences and reflect on their learning, typically for up to ten minutes, before the workshop ends.

5 PILOT WORKSHOP EVALUATION

The research evaluated whether (a) the workshops had effectively implemented the identified design principles and (b) whether this led to increased confidence

Table 2: Data Collection Instruments.

Instrument	Sample	Context	Brief Description
Pre-questionnaire (Quantitative)	Parents	Pre-Workshop	Contains questions and scales adapted from pre-validated instruments (Papastergiou, 2008) to capture confidence and previous experience.
Observation (Qualitative)	Parents, Children	Throughout workshop	Utilising a template to capture observations of parent and child behaviours (Spradley, 2016b).
FieldNotes (Qualitative)	Parents, Children	Throughout workshop, Post-workshop	Utilising a template to capture planning, administration, design, logistics and theoretical issues as well as practical influences which impact workshop delivery written prior to and after workshops.(Emerson et al., 2011)
Artefacts (Products of the Workshop)	Parents, Children	End of workshop	Photographs of artefacts produced during workshops. (Hammersley and Atkinson, 2007)
Focus Group (Qualitative)	Parents	End of workshop	A semi structured conversation (Spradley, 2016a) exploring learning outcomes. Audio recorded.
Post-questionnaire (QUANT + qual)	Parents	Immediately post-workshop	Contains questions and scales adapted from pre-validated instruments (Papastergiou, 2008; Vekiri, 2010) to capture reactions, learning and future intentions.
Follow-up Survey (QUANT + qual)	Parents	>2 months post workshop	Sent >2 months post-workshop to evaluate the extent of any follow on activity (Kirkpatrick, 2007).

in pursuing similar activities in the future. The instruments were therefore designed to investigate changes in participants' confidence by recording self-reported confidence pre- and post-workshop. They also captured the participants' perceptions of the workshop and changes to their future intentions.

These factors were evaluated using 3-cycle action research approach. Each cycle led to minor refinements in the implementation process and improvements in the supporting materials. The methods and results are described below

5.1 Data Collection and Analysis

The evaluation of the workshops utilised multiple mixed-methods research. The data collection instruments administered are described in Table 2

The instrument developed to assess confidence was based on the set of items utilised by (Papastergiou, 2008) to measure Greek high school students' self-efficacy with regard to computers and also previously adapted to investigate teachers' attitudes to coding before and after engaging in a creative computing programme(Oldham et al., 2018). The set consists of ten Likert-type items, each with five responses ("strongly disagree" to "strongly agree"); they formed a scale with Cronbach's alpha .89 (Papastergiou, 2008). Cronbach's alpha measures the internal consistency of a set of items, assigning a value between 0 and 1; higher values indicate greater consistency and hence are deemed to reflect greater reliability for the resulting scale, with the value of .89 typically regarded as "good" verging on "excellent" (Gliem and Gliem, 2003). Items include:

- Item 1: I enjoy working with computers
- Item 4: Computers are far too complicated for me

The post-questionnaire also contained 8 items designed to measure the effectiveness of the implementation of the workshop design principles. These were adapted from a scale developed to measure perception of IS Instruction in Greek middle schools with an 'acceptable' Cronbach's alpha of .71 (Vekiri, 2010). Items include:

- Item 14: One of the things that I liked about the workshop is that we created our own things.
- Item 18: One of the things that I liked about the workshop is that I could collaborate and discuss what we were doing with my family.

Two further items were added to the pre- and post-questionnaires to assess the impact of the workshop on future intentions:

- Item 11: I would like to take part in computing activities with my family in the future
- Item 12: I feel able to organise computing activities with my family at home

The follow-up questionnaire was designed to explore whether the workshop led to any change in behaviour among the participants. Results from this are not yet available.

Data from both questionnaires were entered into SPSS. The responses to items 1-10, dealing with self-reported confidence levels pre- and post workshop were then scored from 1 to 5, or from 5 to 1, so that in each case the higher number reflected greater reported "confidence". Frequency distributions and descriptive statistics were calculated.

With a view to measuring the change in reported confidence, it was necessary to find if the ten items, or a subset of them, could form a scale. Hence, Cronbach's alpha was computed. For all ten items, the value was .945, which is deemed "excellent". The item scores were added and the totals divided by ten, to give a value in the range 1 to 5. This was done for both the pre- and the post- questionnaire.

It remained to compare the pre-workshop and post-workshop scores. Only thirteen of the eighteen participants fully completed the set of ten items. Thus, analysis was restricted to the two sets of thirteen scores. The Shapiro-Wilk test, used because the samples were small, indicated that the distributions could be treated as normal; hence, paired t-tests were carried out to see if there was a significant difference in the means before and after the cycle. For the final 2 items exploring change in future intentions, a similar process was followed and results are displayed and discussed in section 5.3.1.

With regard to the 8 items exploring the perceptions of the workshop, the 16 responses to these questions were scored from 1 to 5, or from 5 to 1, so that in each case the higher number reflected greater reported more positive perceptions. As the sample was small and the questions diverse, the mean response for each question was calculated and displayed in figure 3.

5.2 Recruitment and Implementation

In order to provide a diverse range of relevant cases we used purposive maximum-variation sampling to recruit 3 primary schools (1 Urban, 2 Rural). The recruitment of the participants then used convenience sampling and took place through the parent teacher associations (PTAs) of the selected schools

Three pilot workshops have taken place to date, two in an urban school and one across 2 rural schools between June and October 2018. In total eighteen families (18 parents and 35 children aged 5-13) participated across the three workshops .

- Workshop 1. Large Urban School – 6 families (6 parents, 13 children)
- Workshop 2. 2 small Rural schools combined – 5 families (5 parents, 10 children)
- Workshop 3. Large Urban school - 7 families (7 parents, 12 children)

5.3 Findings

5.3.1 Quantitative Results

Out of a total of 18 parent participants 4 were male and 14 female. They ranged in age from 37 to 63 with 14 out of the 18 aged 43-53.

The two sets of self-reported confidence scores are presented graphically in Figure 2 with each line representing a parent participant. It can be seen that the initial levels were rather high, with only three participants returning a pre-cycle score below the mid-point of the scale. Two participants actually returned slightly lower scores at the end than at the beginning of the cycle; of the other eleven, one stayed the same and ten returned increased scores. However, the mean score rose from 3.44 to 3.74, and the difference is significant at the .05 level (t = 2.835, df = 12, p = .015).

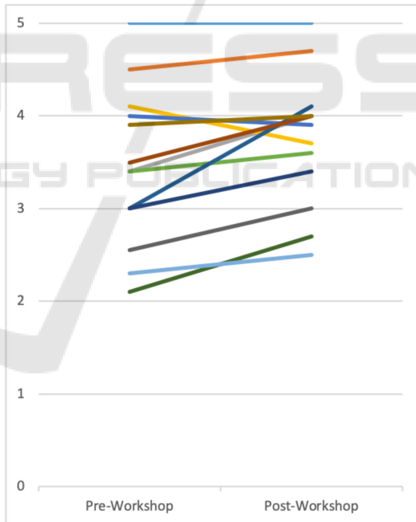

Figure 2: Changes in self-reported confidence.

As can be seen from Figure 3, the items exploring the participants' perception of the workshop provided strong confirmation of the successful implementation of the design principles with the mean responses to all but one of the items scoring between 4 ('agree') and 5 ('strongly agree').

With regard to the two items measuring the future intentions of the workshop, 14 participants responded. Unsurprisingly, as the participants were volunteers, 9 already strongly agreed before the workshop that they would like they would like to take part

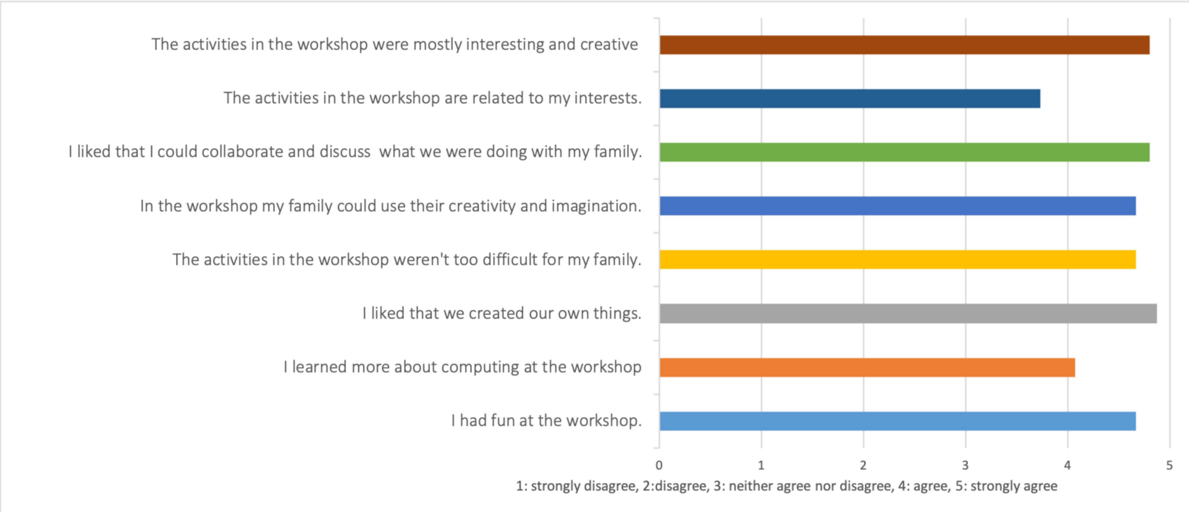

Figure 3: Workshop Perceptions (means, n=16).

in computing activities with their families in the future. Therefore the rise was not statistically significant. However, as can be seen from Figure 4, post-workshop the number strongly agreeing had increased to 12. Of the other 2, 1 had increased from 'neither agree nor disagree' to 'agree' and one had dropped from 'agree' to 'neither agree nor disagree'.

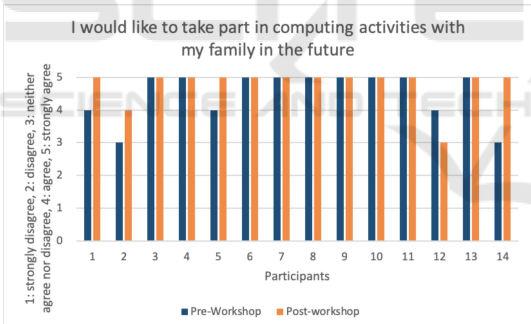

Figure 4: Desire to partake in future family computing activities.

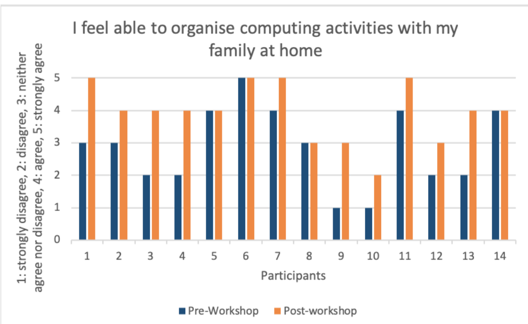

Figure 5: Perceived ability to organise family computing activities.

When asked whether they felt able to organise such activities at home with their families 10 out of the 14 respondents reported feeling more able post-workshop with 4 remaining the same. Here the mean rose from 2.86 to 3.93 a significant rise at the 0.5 level (Figure 5).

5.3.2 Qualitative Results

Quantitative results were supplemented by the qualitative findings of the structured observations and focus groups. The observations recorded considerable excitement and laughter culminating during the 'Share' phase where participants had a chance to show off their creations. Another important observation was the importance of the 'making' element (see Figure 6). Some child participants were observed to be more engaged by 'making' than computing, and providing it maintained a connection with the task. This enhanced collaboration and dialogue within the families.

During the focus group comments were overwhelmingly positive: "A great idea - I feel very disconnected from my kids' computer use", "Thoroughly enjoyed it, time flew. We have already decided to make our own Scratch game together at midterm." Parents commented about the positive use of computing comparing it favourably to their usual interactions giving examples of disagreements about screen time and worrying about online usage. Many remarks were made about increased confidence as a result of the activity, supporting the finding from the questionnaires that overall confidence increased.

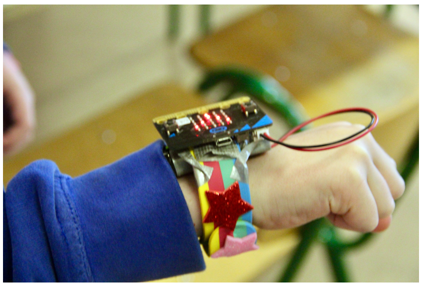

Figure 6: Wearable.

5.4 Discussion

The pilot workshops did result in a number of changes to the initial design. The project aimed to increase confidence in the parents so that they could undertake similar activities at home. Therefore it was particularly important that they did not feel that they needed a facilitator to complete the activities. For the first workshop a Powerpoint presentation and demonstrations of the steps of the activity were projected but it was observed that the participants then overly relied on the facilitator for instruction. For the second workshop we designed and developed the OurKidsCode Cards - A5 cards (described in Section 4). Participants were observed to be much more self-sufficient and independent in their learning with their support. Feedback during the focus group confirmed their value to the parents.

The generally positive results indicate that the workshop design effectively implemented the design principles indicated by the Needs Analysis. There is also evidence that taking part in the workshop achieved its aim of strengthening the participants confidence and readiness to partake in family computing activities. However, some caveats must be entered. First, the number of participants was small and we cannot assume that the results would generalise to other groups. Also we currently are not in a position to know whether the rise in confidence is sustained and whether it has, in fact, led to any further action. We are hopeful that the results of the follow-up questionnaire early in 2019 will give us some insight into these issues.

6 CONCLUSIONS

This paper has described the OurKidsCode project and the design, development and evaluation of the workshops. The evaluation aimed primarily to investigate the effect of the strategy on the participants' confidence in partaking in creative computing activities with their families. Positive results were found for the sample investigated in whom the mean confidence level rose significantly. Also, participants reported satisfaction with and enjoyment of the strategy, particularly the inter-family collaboration and the creation of concrete artefacts. Confidence in their ability to organise such activities also rose significantly. Overall, therefore, it appears that the model has potential for supporting parents as they engage their children in computing and computational thinking.

Training of OurKidsCode facilitators has begun with the aim of a national rollout of the programme in 2019. Twenty-one NPC facilitators have been trained so far in the delivery of the workshop along with 17 others consisting of community workers, coderDojo mentors, teachers and other educators. More training sessions are planned for 2019 and further evaluation and updating with be ongoing as the workshops are delivered. Funding has been secured to design and develop a 4-session weekly programme for families who wish to deepen their involvement. It is hoped that these will also lead to sustainable intra-family communities of creative computing. The project website is being further developed to support these activities.

We anticipate that the design framework that we have developed along with our findings on parents' current capacities, confidence and interest will be of interest to other researchers and practitioners.

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