

Nappy Science Gang

Evaluation report

February 2016

“Both the Flint Water Study and the Nappy Science Gang are examples of what researchers at the University College London (UCL) Extreme Citizen Science (ExCiteS) program are calling Extreme Citizen Science.”

Prof Andrew Maynard, Director,
Risk Innovation Lab, Arizona State University,
in 'Can citizen science empower disenfranchised communities?'
'The Conversation', 27th Jan, 2016

<https://theconversation.com/can-citizen-science-empower-disenfranchised-communities-53625>



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About Nappy Science Gang

Nappy Science Gang is a user-led citizen science project for parents who use reusable (cloth) nappies, funded by the **Wellcome Trust** and the **Royal Society for Chemistry**. The project ran from March 2015 to Feb 2016, mainly consisting of a Facebook group to discuss the science of cloth nappies, and to design and co-ordinate experiments to answer questions of interest to the group. At time of writing, **the Facebook group has 1,097 members**, with more joining every day. (Our target was 100 active members and 200 lurkers)

The group **planned and ran three large-scale experiments in that time** (into the best temperature to wash at, the best washing agent to use, and to investigate what causes a loss of performance in some nappies). These involved **85 volunteers** doing tests in their own homes.

They also had weekly online Q+A sessions with various relevant experts – from detergent and washing technology experts, to statisticians, to help with planning and researching the experiments, and also various experts of general parenting interest, like developmental psychologists.

The group also ran 10 different live events – including stalls at Makefest at MOSI, and at a number of baby fairs, workshops at 2 family-friendly festivals and get-togethers to unveil the experimental results in London and Manchester.

Alongside the Facebook group, they ran a website, which is now a repository of evidence-based nappy washing and parenting information. Along with the results of their experiments. This website has 57 posts in total, 37 Q+A write ups, and the rest other news and results. The site has had over 27,000 views in total. <https://nappysciencegang.wordpress.com/>

Project staff

Manager: Sophia Collins

Co-ordinators: Dr Laura Hobbs, Greta Santagata, Ellen Young

Rationale

Users of cloth nappies have many questions about the best way to wash and care for them – balancing longevity and performance of the nappies against hygiene and thorough cleaning. And the internet is full of contradictory, non-evidence-based, but nonetheless trenchant advice on this topic. It's hard to know which to believe.

Nappy Science Gang aimed to work out what the key questions were, design some experiments to answer those questions, and then run the experiments, ourselves. We've consulted scientists and other experts. But the decisions have all been made by volunteers.

We've tried to introduce an evidence mindset into a sector often awash with hearsay and myths. And we've tried to empower our members and support them in engaging with science, on their own terms.

The project was centred around a Facebook group, where most of the discussion and co-ordination took place. 71% of online adults use Facebook, with most visiting it at least once a day. But there seem to be few public engagement with science projects using it as a venue (other than for one-way promotion).

Key findings

- We engaged over 1,000 volunteers in the Facebook group, more via other nappy-related groups.
- Volunteers designed and ran three large experiments, involving 85 volunteers.
- Having designed and run the experiments themselves, the volunteers feel ownership of the results.
- 67% of volunteers surveyed (58 out of 87) have changed their washing routine as a result of things they learned in this project.
- By asking for evidence, we got the NHS to change their advice on washing powder for baby items.
- Volunteers now ask more questions, and nappy-world myths are more frequently challenged, in the many other cloth nappy groups too.
- Volunteers had fun.
- Experts who took part in chats would all take part again and recommend taking part to a colleague.
- Our expert Q+As have left an online resource of up-to-date, evidence-based parenting information.

Evaluation aims, objectives and outcomes, as set at the start of the project

Aim

To run an innovative and experimental citizen science project which expands the definition of what a citizen science project can be and puts volunteers at the centre.

Objectives

- Run a user-led citizen science project with users of reusable nappies, where users choose the questions, design the experiments and then run them.
- Use a facebook group as a way of co-ordinating this.
- Involve at least 100 active volunteers and at least 200 more 'lurkers' or slightly active members.
- Answer at least three questions of interest to the cloth nappy community using science.
- Gain insight into the benefits and challenges of using Facebook as a venue for a project like this.
- Evaluate project to see if the aims and outcomes have been achieved.

Hoped-for outcomes

- Volunteers feel more comfortable with science and feel more ownership.
- Get people talking about science and some of the mechanics of how to design experiments
- Greater insight for volunteers and interested observers into how science works, what science can do and what it can't.



A young volunteer chews thoughtfully on a Nappy Science Gang experiment pack which has just arrived through the post.

We'll go through the aims, hoped-for outcomes, and objectives in turn, discussing whether we have achieved them. We will illustrate the project with the use of quotations taken from volunteers in online discussions, questionnaire responses, and case studies.

Aim

The aim we set ourselves in the beginning was:-

To run an innovative and experimental citizen science project which expands the definition of what a citizen science project can be and puts volunteers at the centre.

There are very few user-led citizen science projects, so we have tried to be an example of what can be done, and why. As one Nappy Science Gang member summarised the project during a discussion about the results:-

"That is kind of my point. 'Don't do this thing we have picked out of thin air it will invalidate your warranty' I totally understand that manufacturers don't have time or money to test everything. But when myths are perpetuated I think us as consumers are disempowered and there is too much of that going on in parenting."

NSG member Anna Robertson

Parenting is a terrifying and disempowering experience. No matter how secure and experienced you are in your professional life, you suddenly find yourself with no idea what you are doing. It's all too easy for wrong advice, given with certainty, to seem appealing. We have tried to empower parents to ask questions, and not take things for granted.

"When I'm not changing and washing nappies I work as a citizen science researcher and take it from me, this project is special. Why? Because the "citizens" (i.e. all of us!) are the ones asking the questions, directing the study, designing the experiments etc. Most citizen science is much more scientist directed, where scientists come up with the questions and recruit participants to help answer their questions."

Dr Sarah West, Nappy Science Gang volunteer,
and also Research Associate, Stockholm Environment Institute, University of York

"Yet in many of these citizen science projects, researchers remain firmly in the driver's seat – asking the questions, setting the agenda and making sense of the data. They're big on engagement, maybe not so much on empowerment – especially when it comes to issues that directly affect participants' lives.

This is where the Nappy Science Gang is different. It represents an emerging trend where citizens partner with experts to do the science that's useful to them and their community, not just someone else."

Prof Andrew Maynard, Director, Risk Innovation Lab, Arizona State University,
writing in The Conversation, 'The Conversation', 27th Jan, 2016
<https://theconversation.com/can-citizen-science-empower-disenfranchised-communities-53625>

We have practiced extreme democracy as much as possible. The group even decided where our end-of-project event would be held, and where to get the sandwiches from.

Group members suggested possible research questions. Discussed them. Voted for the ones they wanted. Then formed working groups and designed experiments to investigate those questions. Various experts gave us feedback on the draft protocols (as a form of peer review). But it was the volunteers who decided what to do with that feedback. Then agreed the final protocols. And then did the experiments themselves.

We haven't just engaged our volunteers, we've empowered them.

Outcomes?

Based on the hoped-for outcomes we set ourselves before we started, our key 'research questions' are:-

1. Have the volunteers' feelings about/attitude to science changed?
2. Have people talked about science and the mechanics of how to design experiments?
3. Have group members (and non-members) understood more about science and how it works?

But we've realised that there are two crucial assumptions that underpinned the whole plan of doing this project, but that we hadn't really articulated in our aims and objectives.

1. A citizen-led project will ask questions that matter to the community involved, which may have been overlooked by science previously.
2. The research should naturally have an impact on that community.

We'll discuss these latter two in 'Impact'.



Nappy Science Gang make a mess of a sheet, in order to demonstrate the bleaching power of the sun, at their workshop at Northern Green Gathering.

Have the volunteers' feelings about/attitude to science changed?

The quotations below demonstrate the impact the project has had on participants' attitudes towards science.

"I would love to take part in any future experiments you do and thank you so much for all your hard work in organising this one, I have had a lot of fun and re kindled a love for science. I've even got myself on an online short biology course to see how I get on with it."

Tanzi Spencer

"It's made me realise science doesn't equal labs."

Jayne Mardell

"I guess it's made me realise that good questions can come from laymen. And that laymen can be capable of designing experimental protocol with the right guidance."

Genevieve Wheeler Melvin

"Yes it has [changed how I see science] now I see it as more everyday things"

Viki Hans Wright

"Yes it has given me confidence to question things, voice my thoughts and not feel under attack if folk don't agree or I am wrong and made me think about why I do what I do think what I think."

Anna Robertson

Case Study: Jen the nappy volunteer's story

“I started with being a quiet observer on the edges.”

Name: Jen Thompson

Age: 32

Location: Nottingham

Occupation: tax advisor

Highest science qualification: Chemistry A Level

Involvement with nappy world: I have a voluntary role with Notts Cloth Nappies running nappuccinos in Nottingham and loaning cloth nappies to local families

My journey with NSG: I started with being a quiet observer on the edges. I couldn't get to any live chats, but read them afterwards with interest. I posted a comment or two on Facebook. Then Sophia asked for volunteers to help run an information stall at the East Midlands Baby Show, and I helped out. It made a huge difference to me to see and hear about the experiments first hand, so I invited Sophia to our next nappuccino (Cloth nappy information morning) where she spoke about the project and did the flushable liners test. This was a really enjoyable, engaging nappuccino and we had great feedback.

After that, 'team 90°C', in the temperature washing experiment needed a last-minute substitute, as someone dropped out, and I volunteered. The kit came with a few instructions for extra scientific experiments and some litmus paper, which was a nice surprise. It was also really interesting to see how damaged some of the fabrics already were when the nappies arrived.

I was also fortunate enough to get to the results event at the Science Museum, which was really interesting. And it meant I could compare the nappies I'd washed with the ones from the other teams, which was also interesting. I also went on the trip to look at nappies down a scanning electron microscope, at Nottingham University, which was my first time in a real science lab!

I think I have always had a fairly good relationship with science. But this has made me think about the science of nappies. I am more likely to do some absorbency tests on the kit nappies, which I have thought about before but never got round to... NSG has made me curious again.

The effect I have seen as a result of NSG's work is a wider discussion about washing routines based on experience, personal experimenting and results/chats etc from NSG. We have moved away from '1/2 dose of non-bio... Because that is the advice', to a more individual approach, which is getting parents thinking about what works for them and the science behind it - all great stuff! As nappy library volunteers, we have also started to highlight that disposable liners should not be flushed.

Case study: Genevieve the market analyst's story

"I'm glad NSG gave me a shot at being one of the real scientists."

Name: Genevieve Wheeler Melvin

Age: 32

Location: Aberdeen

Occupation: Oil and gas market analyst

Highest science qualification: Do distribution requirements at a US university count? I have no degree in science – mine is actually in English literature. But to get a degree at most American universities, you have to take courses from a broad range of subjects in addition to the ones related to your degree, so I have taken (and passed!) "Intro to Oceanography" and "The Biology of Cancer and AIDS" at UMass Amherst. Both of which I selected because there were no lab sessions with graded experiments for me to mess up. Luckily, we had very engaging lecturers running these courses, and I ended up learning a lot anyway.

Involvement with the nappy world: About 1.5 years of using cloth nappies with my daughter, plus lots of participation in lots of Facebook groups about using, buying, selling and trading nappies. A shocking amount of internet research (reading lots of retailer websites, manufacturer websites, blogs) about the types of nappies available and how to add their use into a modern parent's routine. An even more shocking amount of internet research into washing cloth nappies when my daughter began to get rashes that lasted for weeks and barnyard smells.

My journey: I remember feeling upset that my daughter's nappy rash was outlasting any creams or prescriptions I could give her. I felt frustrated that it seemed to clear up if I put her in disposables, then came back if I put her into the cloth nappies I'd paid good money for and was very attached to using. My daughter's rashes did not seem to be related to teething alone, and I was sure there was something wrong with the cloth nappies themselves. They were smelling awful, even after being washed in the machine, and leaking everywhere. That didn't seem right.

When I first started using cloth nappies, I relied very heavily on washing advice from nappy retailers and manufacturers – many of which firmly stated to use (at most) "a half dose" of detergent. I interpreted this to mean "fill half of one Surf Small and Mighty liquid detergent dosing ball with non-bio powder" – so, for about six months, I washed a 5.85kg load of dirty nappies with approximately 15ml of powdered detergent.

To resolve the stink and leaking problem, I had to strip wash all 40 of my daughter's nappies, which involved a lot of extra work for me. Soaking them in the bathtub overnight in Rock N Green (which seems to be mostly washing soda), splitting them into three separate loads so they could fit into my 6kg washing machine, washing each load 2-3 times on 60 degrees with 100ml of detergent, anxiously watching each load through the machine door, waiting to see when the bubbles would go away. Strip washing took several days to complete. During those several days, I started asking my nappy-related Facebook groups for advice on detergent. I was sure there was a buildup of Persil and wanted reviews on a couple of expensive "nappy friendly" detergents, which were marketed to "rinse cleanly away". A very experienced cloth bum mum gently suggested that those detergents were worthless (in her experience, anyway), and that my problem might be related to not using enough proper washing powder. I thanked her curtly on Facebook for not giving me the answer I wanted. And then I began to Google.

Turned out, there were websites on the internet – mostly based in America – that had been questioning whether the "use less detergent" advice was sound. They were very firm in their opinions. One site ran a large user survey and (essentially) a desktop study of detergents. Some of the writers had fought the same rash battles. The washing advice was mostly tailored

to North American top-loaders, but I gave using a full dose of mainstream detergent a shot. I got the cleanest-smelling nappies I'd had in months, but also soap bubbles on the final rinse. I'd been told over and over that soap bubbles were bad, and I was so confused about the right approach. So, I rinsed, and rinsed some more, and sometimes even washed the nappies twice. My daughter's rash cleared up, but I used a lot of water.

Around that time, Sophia proposed the Nappy Science Gang project in one of the Facebook groups I was a member of. It seemed perfect, and I was keen to join. I guess frustration leads to investigation. I wanted answers – good answers – about how to properly wash cloth nappies and keep rashes away. Because, ultimately, I wanted to keep using cloth nappies on my daughter. If I could get the washing routine right, maybe I could even get some of the environmental street cred back. The idea of performing experiments that we could then evaluate was really exciting.

Nappy Science Gang's effects: Nappy Science Gang created a place for parents to ask questions and support each other seeking out not just answers, but evidence to inform the answers. I didn't expect to be as involved as I have been (and I haven't been nearly as involved as some of the other members). I am not the most scientifically-qualified member of the group. I wasn't entirely sure, at first, what I might be able to contribute, besides the fact that I like to read and can dig up information about niche subjects on the internet. But my questions on the forum have been taken seriously and given good thought. Sometimes, the information I dig up can contribute positively to a discussion. Most of the experts we've chatted with have been polite and really supportive of our questions. I've learned a lot, and through learning, have gained confidence in my ability to learn. For the most part, there has been very little intellectual snobbery in NSG, and I think that has empowered all of us – whether we are educated in a scientific subject or not.

I see this confidence growing in other group members, as they summarize, again and again, what the results tell us so far. I see more people weighing them up when considering their washing approach. I see some group members starting (sometimes very reluctantly, but still starting) to let go of their preconceived notions on "how to do cloth nappies", because of these results. I think some of our experts and advisors may also be revising their opinions, or at least, waiting to see if further investigations can confirm their original hypotheses.

The effects of the project are starting to spread around the other Facebook groups I'm in, too. The "half a dose of detergent" advice still abounds, but I see more parents approaching NSG with questions about washing routines. On the general cloth nappy groups, the experiment results come up more frequently

in our discussions. The nappy retailers and manufacturers who have given (what appears to be) less than ideal advice, are very engaged with their clients on social media, and they are coming up against a lot more of us looking for evidence behind their advice. Some of them seem to be very unhappy that they have work to do.

As for me, I joined the group looking for firm answers to my questions, but have grown more comfortable with the idea of results begetting more investigations. Seeing how that works firsthand has helped me take a more nuanced approach to the science reporting I read on a regular basis (which is mainly about nutrition, but also about diseases). I am trying to grow more comfortable with the heated debates that presenting evidence can generate – what Ben Goldacre calls:

"A kind of intellectual S&M activity ... We know it's good for our souls. If the idea survives, then great; if it needs more evidence, we decide what studies are needed next and do them. Then we all come back next year, tear the evidence apart again, and have another think. Real scientists know this. Only the fakers cry foul." (*I Think You'll Find It's a Bit More Complicated Than That*, 2014, p. xvi)

I'm glad NSG gave me a shot at being one of the real scientists.

Have people talked about science and the mechanics of how to design experiments?

"I thought the results today would bring relief and closure but they've just raised millions more questions. None of my family and friends will mention washing powder in front of me any more..."

Kate O Hara, after the experimental results were announced

This is what the entire project has consisted of, so in a way it is hard to evidence. Extracts of some illustrative example conversations below.

Example 1 – What has caused the 'slug-eaten' bamboo boosters?

The following post led to a 68 comment long thread on what could be causing balding on these boosters, in Penny's home experiments.



Penny's theory is that dry heat is responsible, which she is trying to demonstrate.

Other people disagree and offer contradictory evidence, or alternative explanations of her findings.

Helena Åkerlund Wow! I've abused my bamboo boosters and (continuing now that we no longer use nappies) bamboo wipes and I've never seen anything like it! Some of our cotton terry wipes are going bold, but the bamboo wipes are going strong. They've been washed at 60-90 deg, dried directly on hot radiators and abused in all sorts of ways. No signs of balding whatsoever!

Penny Broderick All washed only with ecoegg. And controls washed with ecoegg too, same cycle, same machine.

Anna Robertson Could it be the ecoegg? Cos I have bamboo which is abused as Helen does. Clean chemicals, hot washes in bio detergent sometimes with vanish oxi. Dried in tumble driers hot. Dried on towel rails. Which is over 10 year-old and no slug damage

Penny Broderick Left for 20 min in the sun but 30 minutes in the radiator experiments. No, I use the ecoeggs

on all the library nappies and all our clothes for a good 4 years now, so it can't be that.

Grace Lee So it could be the action of the eco egg which is exacerbating this as everything with the issue has also been washed with an egg which basically pounds the cloth?

Kate O'Hara What happens if you rub them together when they're in that state? Do they shed the rest of their pile?

Penny Broderick Good question! I'll do that and see! I don't think so, I think I've tried scraping with my fingernail and rewashing them with no more falling out than whatever fell out the first time. I'll go bash these about a bit and report back.

Kirstine Anderson So Kate you mean maybe it is caused by the combination of heat and egoegg? I've got quite a few viscose boosters that have ended up dumped on the radiator and had no problems - but I only wash with detergent after having a disastrous experience with ecoeggs.

Example 2 – the impromptu bra test

It's common to see the advice that you mustn't use microfibre inserts against baby's skin. (On the basis that it would be irritating to the skin) Some of our doughty volunteers got to doubting that advice, and got into quite a discussion about it.

[Sarah MacDonald](#)

I wouldn't use microfibre against the skin

[Laura Hobbs](#)

Maybe we need a new experiment...

[Kate O'Hara](#)

I'd be really surprised if it's really a problem. Nappies are sold with MF inserts and without specific instructions to line them, aren't they? And one of the reasons MF is good is that it feels pretty dry.

Would it be unethical to test?!

[Laura Hobbs](#)

Could we use a proxy for skin? (No idea what, just thinking of getting round the ethics)

[Sarah MacDonald](#)

right I volunteer you to put a microfibre liner in your knickers and sleep with it there all night. I'm not aware of any CSP with microfibre as the top layer.

This culminated in one volunteer rubbing one hand for a few minutes with a microfibre insert, and the other hand with a fleece liner, to see if it was irritating, and posting before and after photos of her hand.

[Kate O'Hara](#)

Not sure if you can see in the pics but my hand looks a little bit redder in the cracks between scales (attractive) of dead/dying skin, as if when it is catching, it's pulling at those edges. It feels a little irritated. That was a right good rubbing for 60 seconds.

Both hands end up looking irritated. She contends that her hands are dry and cracked (she has eczema), so may not be a fair test.

So she rubs the underside of her boobs (which for various reasons we declare to be more baby's bottom like) – one with microfibre, one with fleece.

[Kate O'Hara](#)

No damage I can discern or feel on either side.

This doesn't produce much effect.

So after further discussion, she decides that sitting next to the skin longer term may be a fairer test, and puts a microfibre insert into one side of her bra, and a fleece liner into the other.

[Kate O'Hara](#)

It's been about ten minutes and I can confirm both MF terry under right boob and fleece under left boob feel prickly and horrible and are driving me daft. Interesting.

Example 3 – the great enzymes controversy test

Since we got the NHS to agree that biological detergents are not *a priori* bad for baby's skin, some people in nappy world (and some members of the group) are insisting that bio detergents are still bad, because the enzymes they contain will 'eat away' at cellulose-based

fibres (viscose bamboo and cotton).

There has been a considerable amount of back and forth in the group about this (and heated discussion in other nappy groups), with little hard evidence apparently available. (i.e. we know that they will have some effect, but is it very small, and shortening the life of your nappies by one or two washes, or is it large, and shortening the life of your nappies by years?)

One member of what we might call the pro-enzymes camp is running her own experiments at home.

Chantelle Leovborg: I have just finished soaking bamboo for a week in enzymes vs. rockin green. no visible damage-- will test absorbency tomorrow hopefully

I changed out the solution 3x and shook it as often as i thought of it to agitate

so what is that equivalent to. . . 50-100 washes roughly. More I guess since a wash wouldn't have detergent sitting on it for the entire cycle

Chantelle Loeborg

I put the water in around 40, but actually enzymes are denatured above 60. I don't think they work any better or worse based on temp

Jenny McIntosh

Chantelle- the enzymes might not be stable once in solution, so may not be equivalent to 50-100 washes.

Chantelle Loeborg

Yes that is why I changed the solution 3x. Also used a much higher concentration than what would normally be interacting w the fabric

But would be good to know for how long enzymes are active when mixed into water

Jenny McIntosh

Might only work for a couple of hours. A more concentrated wash solution could be inhibitory to the enzymes as the other constituents of the detergent will also be at a high concentration than intended. Of course the companies will have the information, but am guessing that information will not be public.

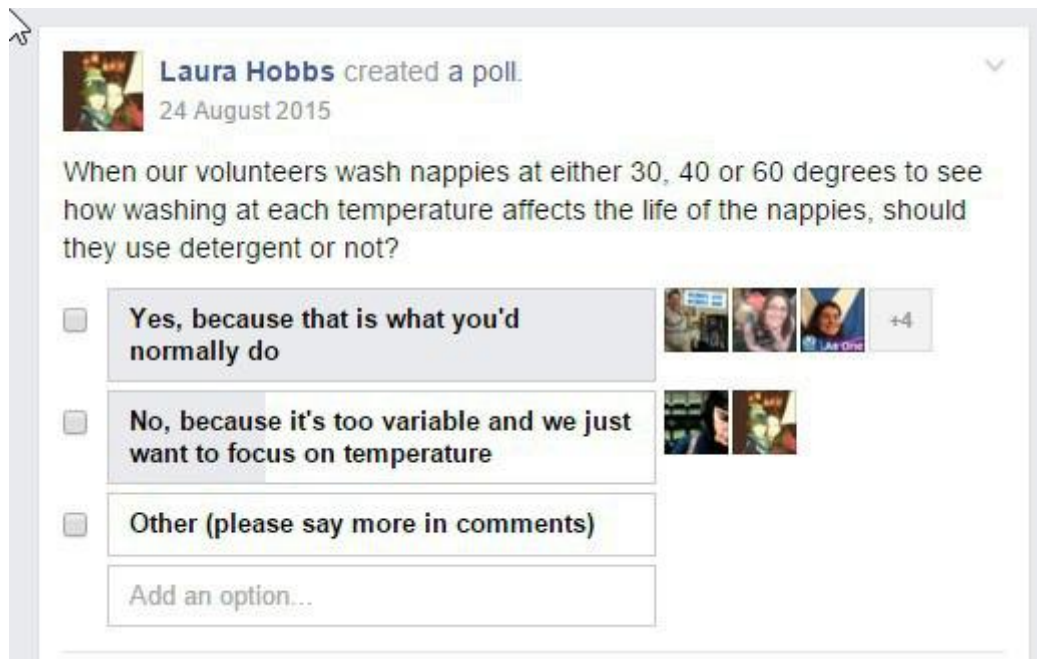
Example 4 – to detergent or not to detergent?

One of the experiment strands was to try to work out the best temperature for washing your nappies. We realised that 'best' was a slippery concept. The highest temperature possible would give you the cleanest nappies. But it would also quickly destroy your nappies. The lowest temperature possible would be gentlest to your nappies, but it might not be very hygienic. The group designed a two-pronged approach,

1, testing how well bacteria survived in different temperature washes

2, testing how well identical sets of nappies held up to being washed 100 times at various temperatures.

Here we find them discussing whether the test sets of nappies should be washed with or without detergent.



Suzie Mitchell-Howard Could you do half and half, so using detergent and not using detergent could be a factor in the results?

Rachel SilverRocket Isn't there a generic detergent used in testing machines? Or pick a standard non-bio (fairly or supermarket own brand) and send some out.

Greta Santagata I would say no because we're JUST looking at the effect if temperature on clean nappies, and adding detergent seems irrelevant (as well as being wasteful + an extra cost + an extra variable to control, so more difficult for volunteers)

Rachel SilverRocket Detergent must contribute to wear and tear no? So it still seems a bit unrealistic to not include it.

Sarah MacDonald but nobody washes their clothes or nappies with no detergent so to just wash with water seems very unrealistic. I know there is no soiling but if optical brighteners, bleaching agents or other ingredients affect the wear and tear then I think there should be a detergent in there. Same used for all the temps and like Rachel said a generic supermarket non bio white powder

Kate O'Hara Yes, because it may contribute to wear and it's what most people do. Can we use the standardised one (EEC or something?)?

Example 5 – How many washes?

We wanted to decide how many times to wash our test nappies. In the end, 100 times was the highest number we thought was feasible. We wanted to work out what period of normal wear that worked out to be (and how that compared to a reasonable expectation of a nappy's lifespan).

Laura Hobbs The survey results could give a good idea of how often nappies get washed (even if you're using them part time, if you're still using them regularly they will still be getting washed regularly, iyswim), if we get enough responses, and then can scale that up from weekly frequency to how many washes in a year and so on.

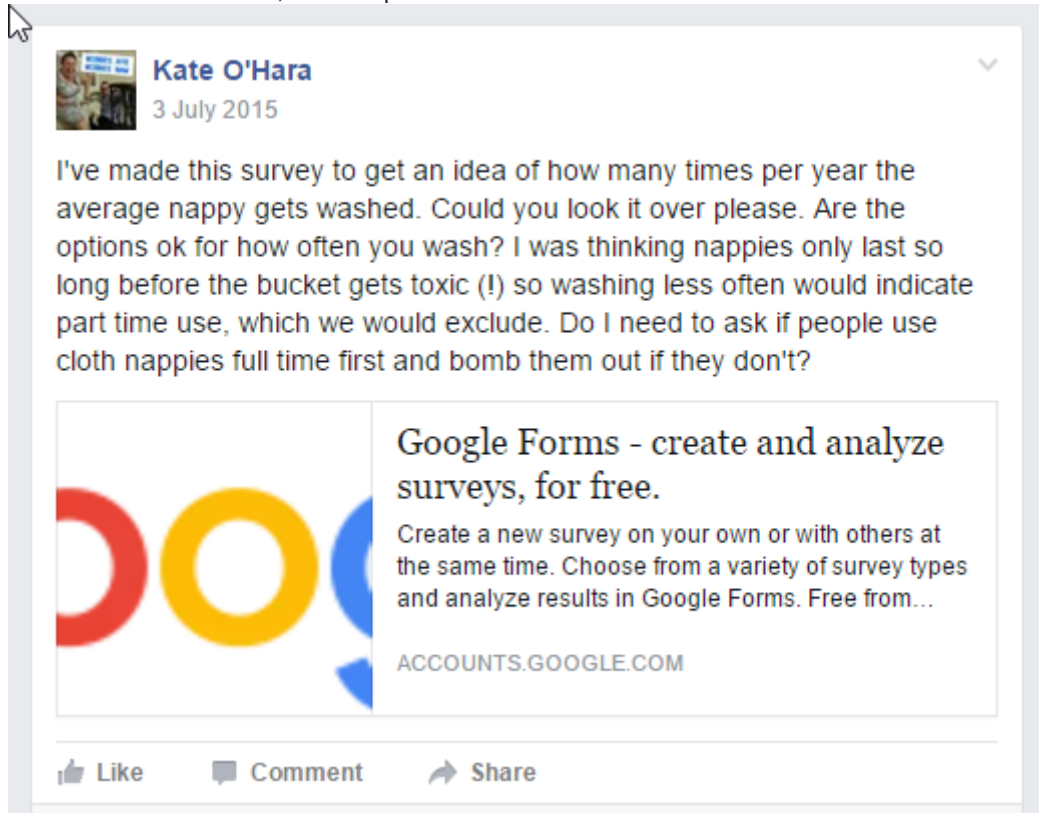
Dani Louise Sharlot You can use my calculation as a theoretical, compare that with actual surveyed results and that give us a more reputable figure to estimate. If most of the responses tell us that they wash their nappies between 104 and 59 times a year then we know our calculations are correct and we can use them as a standard, or if the results seem to collect at a certain amount - lets say 80, we then backwards calculate the usage from that and use that for our test, detailing the whole above process in our findings. That way we can justify why we chose the certain washes and provide studies that show the amount is commonly used (true result). If that makes any sense?

Kate O'Hara I don't think it matters if people use the same nappies from their stash more often as we'd still get their total number of single use/washes. I'd foresee a statement something along the lines of "x washes per year based on use in a regular rotation of y nappies". I think that would still be a useful number for our purposes. It would give us an idea of how the number of washes in our experiment compares to average use. The user could see how the wear on their nappies

would compare to the average if say they have fewer nappies or they use their favourites more often.

Yes, I see what you mean. It is better to just include all users, full time or otherwise.

Kate O'Hara So 100 washes per year is our guess but if we get numbers from users we might find that our 100 washes is actually more like 10 or 14 months, for example.



Kate O'Hara
3 July 2015

I've made this survey to get an idea of how many times per year the average nappy gets washed. Could you look it over please. Are the options ok for how often you wash? I was thinking nappies only last so long before the bucket gets toxic (!) so washing less often would indicate part time use, which we would exclude. Do I need to ask if people use cloth nappies full time first and bomb them out if they don't?

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Create a new survey on your own or with others at the same time. Choose from a variety of survey types and analyze results in Google Forms. Free from...
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Case study: Mark the chemistry advisor

“Members of NSG with no science training have understood quite complex chemical interactions”

Name: Mark Smith

Age: 52

Occupation: Scientific Consultant

Highest science qualification: Chartered Scientist, Chartered Chemist

Involvement in nappy world: Just through Nappy Science Gang

My journey: I am a member of the RSC Water Science Forum Committee. I am also a member of the RSC Inclusion and Diversity Committee. I am also one of the RSC 175 faces of chemistry. I have taken part in public outreach by providing public lectures on water science and treatment. I was also for many years the Treasurer of the Chemistry Section of the British Association for the Advancement of Science, now the British science association.

NSG has made me consider how we communicate often complex scientific information to people with no scientific background. How questions from non specialists can make you look at principles and theories in a different light. It has been enjoyable working and talking to its members.

Nappy Science Gang's effects: NSG has been effective in trying to find out the scientific basis of claims and perceptions within the cloth nappy using world. By asking questions NSG has started to change advice and get advice based upon scientific principles. Members of NSG with no science training have understood quite complex chemical interactions, such as how oxygen based bleaching systems work within detergent formulations as well as what the different components of the formulation achieve. The NSG members have then become advocates in explaining these often complex interactions and principles to new members of the group.

Case study: Feedback survey responses

We asked volunteers in the end of project survey, "Has this experience taught you anything about designing experiments?"

By far the most common response was that **it's really hard**,

"It's hard!"

"Yes, it's harder than you think!"

And also, time consuming,

"Quite a long and lengthy process!"

"Give yourself enough time!"

And mainly, they realised, it's hard and time consuming, because of the *difficulty of isolating variables*,

"There are so many areas which can change the experiment, everything needs to be considered."

"It's extremely difficult to identify all the variables, let alone put in controls for them."

"Think it has taught me the sheer number of variables involved in testing anything, so you have to spend a lot more time designing the experiment than you might expect."

"That even when you think you have everything covered you probably don't."

You've got to consider the 'end-users' when you are designing your experiments

"That if you live and breathe something then you may assume things (like to use the laundry tabs) but it isn't obvious to a non user or a new user."

"You've got to bear in mind how easy they are for the participants."

That it can be an iterative process,

"As suspected, even the simplest ideas are mad up of massively complicated steps and processes. Some of which don't come to light until the experiment is running."

But there's still a point in doing it,

"Yes. I've learned that even if we can't control all variables, we can control some. And that can be enough of a place to start from."

We contend that these responses suggest the volunteers have had a very good insight into science and how it works.

Impact

People mostly joined the group because they wanted evidence-based information about washing nappies. For example, in our initial survey for people who'd just joined the group, when asked 'What do you hope to get out of being involved in this project?', 86.7% of people (156 out of 180) answered some variation on 'to gain information, answers'. (e.g. "I'd like more evidence for issues regarding cloth since every person says different conflicting advice." "Find out how to wash nappies properly- have had smelly nappies at times." "Accurate, impartial information to provide to potential cloth users via my cloth nappy library")

Have they found their answers, and has it been useful to them? The most obvious place to look for impact is therefore in their behaviour.

Washing behaviour

In our end-of-project survey, we asked members of the group, **"Have you changed your washing routine in any way as a result of this project?" 67% (58 out of 87) said yes.**

We circulated a survey around other cloth nappy and parenting groups, to get an idea of the **impact on the wider community**. (This survey was very short and entered people into a prize draw, in the hope that there was an incentive for people to fill it in, even if they hadn't heard of us)

43% (70 out of 162) had heard of Nappy Science Gang, and **23% (38 out of 162) had changed their washing routine as a result.**

Case study: Professionalism in the cloth nappy world

Common barriers to people using reusable nappies are not knowing anyone who uses them and finding it off-putting. And outdated ideas that the only option is terry squares, nappy pins and plastic pants and boilwashing everything once a week. So demos from nappy libraries are a key way to reach out to people who may be interested, but don't know anyone who uses cloth already.

At present many children's centres refuse to have people from nappy libraries come in to give demos. Because there is no accredited training so there is nothing to satisfy a bureaucracy that this person knows what they are talking about and can give reliable information. Penny Broderick (of the nappy library information network) is writing a training course for cloth nappies to address this. Nappy Science Gang's research and expert chats are feeding in to that training design and helping her access info she couldn't on her own.

"The detergent expert one was so so useful. It's all been so useful! I don't think I could be writing this training course without Nappy Science Gang. The information just wasn't there."

Penny Broderick, UK nappy libraries information network

"We have just re-written our washing guidelines for our customers. We are quite impressed with all the work and info you are producing that was very much needed."

Laura Finnegan, Ecopipo nappies

Case study: Kate the music teacher's story

“I feel this project has genuinely sent big ripples through the cloth nappy world.”

Name: Kate O'Hara

Age: 36

Occupation: Mother and Music Teacher

Highest science qualification: (Scottish) Higher Chemistry and Physics

Involvement with nappy world: A user of cloth nappies on my own children who has been frustrated by the apparent rubbish talked on the internet about how to wash nappies.

My NSG journey: As a lover of science and a sceptic in general, the cloth nappy world drives me mad: myth and legend abounds and people pass on second hand 'truths' and rules for washing nappies without ever considering their provenance. I jumped at the chance to be able to apply a bit of science and perhaps uncover some truths. It's been really enriching learning from experts how to do the science and then using my own brain cells to think critically about things and design the tests. And it's been so heartening having input from the professionals on our 'niche' area of interest: both in terms of being reassured that science can work for me, and in terms of enjoying an intellectual ego boost when an expert sincerely (and patiently and with professionalism) engages with your attempts at working in their field.

NSG's effects: I feel this project has genuinely sent big ripples through the cloth nappy world. In the internet discussion groups where the nappy world largely resides, the loudest voice usually wins; now I am seeing some people beginning to question the claims of loud-voiced others, and people beginning to look for, listen to and present evidence in support of claims.

Has there been any wider impact?

Does empowering lay communities to ask scientific questions relevant to them have any wider impacts? Do they ask questions other people have missed? Were there any benefits not just to the group involved, or to the wider cloth nappy community, but beyond? Happily, yes.

Case study: the NHS and bio detergent

"I would never have thought to write to them about this. I just assumed there was some reason for the advice. Until your volunteers kept asking these questions."

One question discussed a lot in the group was biological vs non-biological detergent. i.e. detergents containing enzymes to assist cleaning, and those which don't. It was very commonly said in the UK cloth nappy world that you shouldn't use bio on nappies as it can cause skin irritation to babies. And the NHS advice was to use only non-bio on all baby items. But once our volunteers started asking questions, there was no stopping them, and several members got particularly stuck in to this question.

As far as we could work out, bio vs non-bio detergents are a peculiarity of the UK and Irish detergent markets. In most parts of the world they don't have bio and non-bio, and nearly all detergents will contain enzymes. Our volunteers found a scientific review paper which concluded that bio detergents are no more likely to cause skin irritation than non-bio. "Investigations of numerous individuals with skin complaints attributed to laundry products demonstrate convincingly that enzymes were not responsible."

The perfumes in detergents are, in fact, the thing most likely to cause skin irritation. And they are found in both bio and non-bio detergents. That British and Irish people believe, in such numbers, that they are sensitive to bio detergents looks like large-scale confirmation bias.

So why was the NHS advice as it was? One of our science advisors (Mark Smith, a chemist and detergent testing consultant) wondered the same thing, and wrote to the NHS to ask them what evidence their advice was based on. They checked and couldn't find anything. They asked Professor Hywel Williams, professor of Dermato-Epidemiology and co-director of the Centre of Evidence-Based Dermatology at the University of Nottingham, and he replied, "I know of no good evidence that supports avoidance of biological washing powders or fabric conditioners and use of non-bio instead."

The NHS have therefore changed their guidelines.

Mark Smith said, "I would never have thought to write to them about this. I just assumed there was some reason for the advice. Until your volunteers kept asking these questions."

This story got a lot of coverage. Our initial blogpost about it was tweeted 79 times. And read 4,398 times. Our impression from looking through the retweets was this was mainly science communication/public engagement/citizen science audiences. i.e. my professional peers.

We then wrote a post for 'Sifting the Evidence', a Guardian science blog by Suzi Gage. This had 33,000 page views in one day.

"The main guardian account has tweeted it three times. They have NEVER tweeted anything I've ever written more than twice before, so they really like it" Suzi Gage. Our impression from looking through the retweets was that this was then being shared by a different audience – local NCT groups, nappy libraries, health visitors' organisations. (So, professionals and 'super-peers' in parenting circles) As well as various ordinary people who were interested in the story, some who had strong views either way about biological detergent.

We were also interviewed on Radio Scotland, on the Kay Adams show. Reblogged on the 'Ask for Evidence' website. And covered in a piece on the Huffington Post.

Suffice to say, this story reached a lot more people than we'd been aiming for.

Impact from the impact

"Gonna use this in my lecture on Tuesday..." Dr Kieron Flanagan, Senior Lecturer in Science and Technology Policy, University of Manchester, upon reading about the NHS non-bio story.

"Makes me want to 'do' a citizen science project, but wouldn't know where to begin. Will you/have you written a manual?" Dr Tom Hartley, Psychology lecturer, University of York

Mini case study: Live chat write-ups

"We probably wouldn't have come across it by ourselves, but it's got really useful insights."

Most weeks during the project we have had an live chat online with an expert of interest to the group – some very specific, like detergent experts or washing machine testers, some of more general interest, like psychologists who study child development. One week's chat was with Claire Noble and Jamie Lingwood, from the University of Liverpool, who study the effects of reading with your children on children's language development.

<https://nappysciencegang.wordpress.com/2015/09/25/live-chat-with-language-development-researchers-jamie-and-claire/>

Laura Hobbs, one of the project co-ordinators, emailed this link to an editor at the Book Trust. They replied, "Thanks for this. We probably wouldn't have come across it by ourselves, but it's got really useful insights. I've forwarded it to all our heads of department."

We tend to assume that an organisation like the Book Trust knows everything about the importance of reading to children. But they can still be surprised.

In general, a lot of what is online (or what is easy to find online) about child development and parenting is not that evidence-based, and may be many steps removed from original research. So there really is a lot of value in talking to cutting edge researchers and putting the conversation up online. It can be a low stress way for them to get some useful content online. And it can be useful for parents to find information that they know is accurate and up-to-date.

Case study: Kirstine, the Chemistry teacher

“Many parenting areas online have self-styled experts and nobody dares to disagree with them”

Name: Kirstine Anderson

Age: 35

Location: Manchester

Occupation: Chemistry teacher

Highest science qualification: PhD

Involvement in nappy world: I've cloth napped two children (both now potty trained) but never managed cloth nights!

My journey: The project has reignited my love of scientific investigation and reinstated my belief in science over hearsay. I've previously found many of that 'facts' discussed by nappy users online a little suspicious but as it's not my area of expertise, I've not been confident enough to speak out. Since the project, I know that many of these claims are unfounded or outright wrong and feel more confident to question 'expert advice' regarding nappies (and indeed, other parenting choices) if a scientific basis is not clear.

The effects of Nappy Science Gang: I think a lot of people feel the same as me, but that effect is much more profound when the person involved does not have a scientific background. Many parenting areas online have self-styled experts and nobody dares to disagree with them, but now many more parents are armed with the confidence and knowledge to demand the evidence before accepting the claim. This can only be a good thing! In terms of the nappy world, there are so many questions that we all want to answer and the curiosity of many people is piqued, but the things that will stay with is all are:

- It's viscose (not bamboo)
- Bio is fine
- Wash at 40 with the odd 90 wash to 'strip'
- Not that detergent residue exists of course!

I would jump on the opportunity to be involved in a similar project again.

Objectives

Run a user-led citizen science project with users of reusable nappies, where users choose the questions, design the experiments and then run them.

We asked for suggestions of questions to investigate even before we were given the People Award. There were several busy threads on the Facebook group and over 80 questions were suggested and discussed over a couple of months.

To make it more manageable, we made a shortlist of the 20 questions that had generated the most discussion, and the group voted on that. We then chose the three questions that got the most votes, which were:-

- What's the best thing to wash cloth nappies with (bio detergent/non-bio detergent/liquid/powder/Eco eggs/Soapnuts)?
- What is the best temperature to wash your cloth nappies?
- Is 'strip-washing' cloth nappies necessary? If so, what is the best method? *(It's commonly said that detergent build-up in nappies can cause you problems, hence the counter-intuitive but ubiquitous advice to use half the normal dose of detergent. It's also said that if you get this build-up you need to 'strip-wash'. Opinions differ on the best way of doing this.)*

We then formed three working parties (one for each question) to work towards a protocol for each experiment. In theory these working groups could then focus in a more sustained way on hammering out the issues, come up with a plan and then feed back to the main group with ideas and for input. In practice this was the part of the plan which worked least well as there was no real accountability.

We had a 'bystander problem' as some people signed up for the working group out of nosiness but didn't contribute to the discussion. Or some people would just point out problems, without then sticking around to try to help solve them. And people could suggest cumbersome or unworkable plans without having to be the ones actually carrying them out.

We've discussed it a lot and think that small teams working on a given question would work best. Perhaps discussing it in a pm thread, rather than a discussion in a group. As it's easier to throw ideas around in a more private setting, and people feel more obliged to reply.

However, with much prompting, we did eventually come up with suggested protocols. These were sent to our various expert advisors for input. Then the groups incorporated any suggestions or addressed issues, to come up with final protocols. Which we then carried out.

Use a Facebook group as a way of co-ordinating this

We ran an open Facebook group (so anyone can see everything that happens in the group). We chose to use Facebook as it is a popular social media platform, especially used for interaction, and by people who don't use other social media (e.g. my Mum is on Facebook, but she's not on Twitter, Instagram, Whatsapp, etc). It's also not commonly been used as a venue for public engagement with science projects. We thought it would be the right venue for this project, and also that it would be useful and interesting to get insight into the benefits and challenges of using Facebook for citizen science and public engagement. (See later section, discussing what we found).

The group was used for discussions, polls and sharing files and links, to come up with possible questions to investigate, to discuss those questions, to choose which ones to investigate, to develop our protocols and to co-ordinate the experiments themselves.

We also used the group to make invites for 'events' of weekly live chats with various experts. We wrote up each live chat as a blogpost, on a separate website, so that there was somewhere with a permanent record of what we'd found out. And so that people who aren't on Facebook could easily access our findings, and they could be found in web searches.

We conducted our 'live chats' in a special 'Nappy Zone' on the I'm a Scientist website, which Gallomanor kindly loaned us.

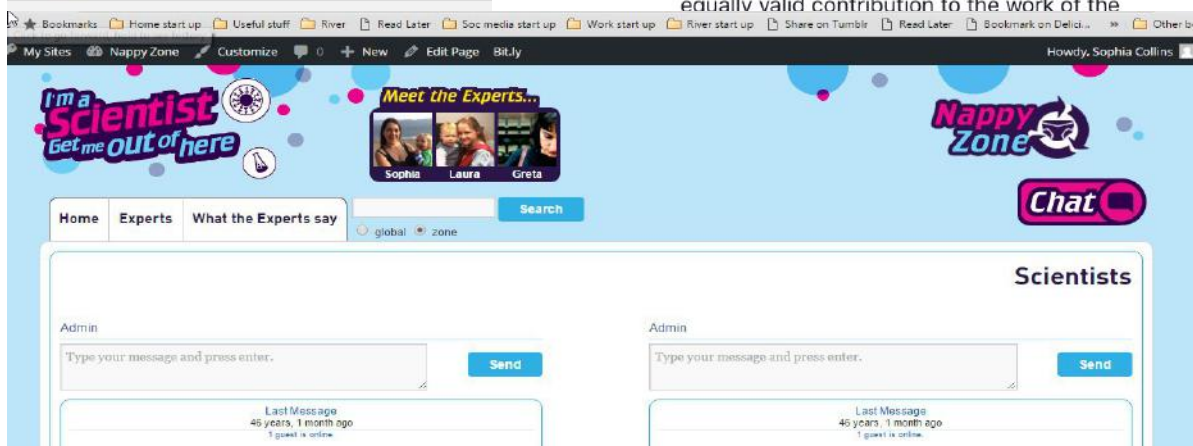


Advice will be given by professional scientists, and some tests will have to be done in a lab, but the group will be in control of the project at all times.

This is a citizen science project - engaging non-scientists with the scientific methods that can help them answer questions that are relevant to their everyday lives. No background in or experience of science is needed - just an interest in cloth nappies and a desire to uncover some scientific facts about their use.

We have some GUIDELINES we'd like you to follow so that we can work together safely and harmoniously. Please take a look at these before posting in the group.

1. All group members, whatever their background, are capable of making an equally valid contribution to the work of the



Involve at least 100 active volunteers and at least 200 more ‘lurkers’, or slightly active members

We had:-

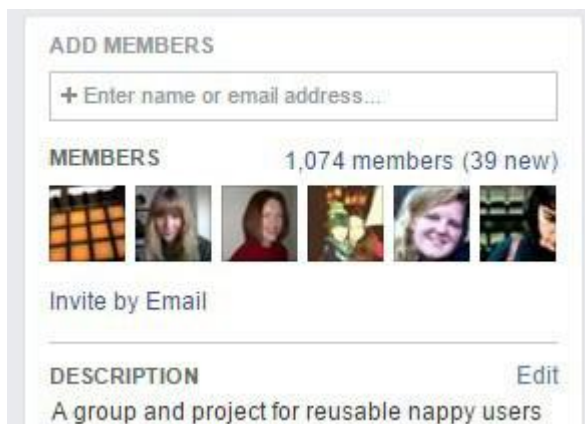
63 people come and ask questions in live chats with experts

44 people join the busiest working group, to design the detergent experiments (23 members each in the other two working groups, with some overlap in membership).

171 people volunteer to take part in the experiments

85 people altogether assigned to take part in the experiments (with 78 completing the experiments)

At time of writing there are 1,097 members of the Facebook group, of which more than 200 have commented.



Case study: Hayley's story

“I even had my husband youtubing how to fold terry nappies and using a teddy to demonstrate!”

My name is Hayley Hindley, I'm 32. I have two boys aged 11 and 14 months. I'm a playworker in an after-school club. I live in Gomersal, near Bradford. I never thought about using cloth nappies with my first but when I fell pregnant with my second it was something I wanted to try! I had seen a Facebook friend showing off a custom nappy and fell in love!

Anyway when I saw the advert for volunteers for nappy washing I jumped at the chance. It was at the time when I was thinking of the dreaded time of going back to work after having my baby and thinking about options of working from home, but still earning enough money to live comfortably. I'm a member of a couple of cloth nappy groups on Facebook and I've noticed that people recommend different washing techniques. So I thought this would be an ideal opportunity to set the record straight.

So the nappies arrived I was so excited, as I had only really seen my stash the different varieties in the pack was awesome to see. I even had my husband youtubing how to fold terry nappies and using a teddy to demonstrate! He helped me with measuring and weighing the nappies too. We both had fun! I did find the washing of them quite a hard task. Finding time to wash them and keep up with my own washing was difficult but I did manage it and was pleased when I had finished and was able to send them off to the next person.

Although I haven't had chance to read the final results I'm hoping that they say washing nappies at 40 degrees is fine as this is the setting I use ha! I have a feeling the washing at 90 will damage the nappies badly and washing at 30 may not clean the nappies properly!

I did actually really enjoy taking part and am glad I did.

Could you say anything about what the effect of NSG has been on other people/in general?

I guess it will give people insight into how washing nappies affects their lifespan. That's quite difficult to answer! Maybe it's given people a chance to experiment with different temperatures so that we all know how best to wash our nappies best!

Using Facebook as a venue for public engagement

Advantages

People 'already live there'.

- You aren't trying to drag them to somewhere you want them to come to, you've come to where they are.
- They know how stuff works, they know the medium. For most people who joined the group anyway, they are in other nappy-related groups (either advice and chat, or buying and selling groups), or other parenting groups, so they know all the fiddly things about Facebook, like how to search for posts, how to check their 'others' folder.
- You are asking many people to learn something new in approaching things scientifically, designing experiments, etc, it helps that you aren't adding to that by using an unfamiliar venue with rules or codes they have to learn.
- There are distributed communities co-ordinating themselves via facebook groups already and we just need to learn from them. Many of the practical problems we had to work out have already been solved, and the community you are engaging are familiar and comfortable with the solutions.
 - e.g. we are running a project spread out across the country, and most volunteers are never going to meet. How do we transport nappies around? - everyone who buys and sells nappies knows how to use MyHermes and similar couriers. They know the Royal Mail parcel sizes and so on.
 - e.g. how do we pay volunteers for nappies they are sacrificing for science? Paypal – which is how everyone pays each other to buy and sell second hand nappies and kids' clothes. Everyone is familiar with it and it's not intimidating.

It's a social space, set up for ease of use and friendly exchanges. It's easy to do polls, put up photos, link to things.

We set up a 'secret group' for the staff working on the project to co-ordinate too, instead of using basecamp or some other online collaborative tool. As we wanted to be fully testing the use of Facebook for public engagement projects.

- It made it easy to move between our 'behind the scenes' space and the main group. We could add files, have discussions. But it is not as full-featured as something like basecamp, and in particular it is easy to miss notifications and therefore not see important messages, so we ended up using group pm threads a lot.

Groups are the 'natural amplifiers' of Facebook. Years ago someone said to me that the great thing about twitter for getting messages out there was that you could get retweeted by someone with a lot more followers than you, and suddenly your message is amplified. Whereas on Facebook, that couldn't happen. But now, I think, with groups (and pages), you can get a similar effect.

- We would post links to write-ups of our chat in a couple of relevant groups, and see a big spike in blog traffic when we did that.
- Sometimes we would see an unexplained spike in blog traffic, or in new members joining, and later find that someone had mentioned NSG in a discussion in another group.

Disadvantages

People already live there.

- There are a lot of distractions online, and on facebook.
- Even if you tag people on posts, people get a lot of notifications, so they can easily miss your messages.
- People get distracted, they are on Facebook to 'hang out', so anything too boring, or hard work to answer people will skim over.
- For staff on the project too, Facebook is also a social space. So it's easy to log on to do some work thing, and then take much longer than you meant to because you get distracted by various other things on Facebook.
- Friends (or unwelcome acquaintances!) may message you, not realising that you are 'at work'.
- It's like you are trying to do your job in an enormous busy pub, where everyone you know happens to be drinking.

Even though someone has joined your group, Facebook doesn't necessarily show them posts from your group in their newsfeed. Facebook are secretive about how their algorithms work, and they keep changing them anyway. But, broadly, the more people interact with the group, the more likely it is that stuff from the group will appear in their newsfeeds.

- So, we put up lots of little polls and easy to answer questions, "What's your favourite nappy?" It was still hard work and sometimes, even though we had hundreds of members, some posts would get no response at all. With no way of knowing, 'has no-one seen this?', or has everyone seen it but they just don't want to answer?

Search in Facebook is a bit rubbish.

- You can only search in the group if you are in a browser, not in the app. According to a poll we ran, nearly all of our members are accessing the group on their phones most of the time.
- There is a 'Facebook groups app', which allows you to search from a phone. But it's a bit clunky. And not everyone wants to download extra apps.
- You can only search within a pm thread in a browser, and even then, you can't actually go to the part of the conversation you've searched for. You can just see a snippet of it. Which means you need to make a note of anything important said in pm threads, somewhere else. Or do a lot of scrolling.

Once you have 500+ people in your group, you can no longer invite all members of the group to an event.

- So you have to go through laboriously inviting people individually.
- For some reason if you create the event in a browser, you can only invite people in the group you are 'Facebook friends' with. But if you do it on the Facebook phone app, you can go through the members list for the group, inviting up to 500 people.
- Once we had a lot more than 500 members, we would go through just inviting, e.g., the first half of the alphabet to this week's event. And the second half to next week's.

Lessons we learned about running a user-led Citizen Science project

People need more pushing, prodding and structure than we thought.

- We'd thought that once people had talked through ideas of things to investigate, and chosen the questions they wanted to do, then getting them to actually design protocols would be easy.
- **But actually, designing experimental protocols is hard.** And doing it online, it's easy for people to just click by. If you had people in a room, you could set each table a task and come back at the end of an allotted time period and they'd have done something – even if it needed some work. But online people can just read the question and go, 'Hmm, I don't know', and never come back to it.
- We need to work out the online/Facebook equivalent of being in room together and there being something to push people towards actually completing even difficult tasks.
- It seems people needed longer to have bedded in to the group. Because later in the project, the volunteers were doing a lot of complicated, and/or tedious stuff, for little reward, when they were taking part in the experiments. But perhaps people felt more 'committed' then.

Take A LOT of contact details from people

- People filled in a form to volunteer for the experiments and (incredibly), we only asked them for their names, and addresses (for posting packs out). Not email addresses or telephone numbers.
- We thought they'd all be in the Facebook group, but actually, 2/3 of them weren't, as members had shared our call for volunteers with friends and local nappy groups, etc.
- Even the ones who were in the group, sometimes had given different names on the form to their Facebook name.
- And Facebook isn't always the best way to contact people. Not everyone is on it every day.
- This all led to a lot of time-consuming work trying to track people down or get hold of them.
- This also meant that people who dropped out of the experiment left the Facebook group and were then hard to get hold of and we had no way of chasing them to find out what had happened, or ask for our experiment packs back.

Always do a trial run of the experiments.

- Many mistakes were made that could have been avoided if we had done this.
- In particular, the instructions were confusing or ambiguous in places, so people either had lots of questions (which was time consuming to respond to), or they didn't ask questions, but just guessed, and so different people did different things.
- We didn't think we had time to do a trial run, but not doing one cost us a lot more time in the end. We definitely didn't have time **not** to do a trial run.

A LOT of encouragement and chasing people up is needed

- This was the most important learning point from the experiment phase (alongside trialling the experiment) – in the end chasing people up took up more time than any other activity (Almost every single person doing the experiments needed chasing up at

least once). A better system for doing this implemented from the start would have meant the experiment ran more smoothly.

- The things people needed chasing up on most often: sending on the box of nappies after they had finished washing in the temp washing experiment (in many cases people took weeks to do this and took four or more emails to encourage them to do this), filling in post-experiment survey forms, doing the detergents experiment.

Instruction sheets need to be more detailed and account for EVERY eventuality, even if it seems really obvious. For example:

- Temperature washing experiments did not specify to stick together the velcro of the nappies (nappies have 'laundry tabs' for you to stick the velcro down, so that the velcros don't all get stuck together in the washing machine) so some of the nappies got damaged this way instead of by just washing.
- Many people did not write their names on the swabs – should have specified to do this. Some people wrote nothing at all on the swabs.
- Many people were confused by the fact that the instructions for the final experiments after the temp washing experiment were included in the survey and not in the instructions.

People are busy - experiments take a long time and people drop out

- More 'lead in' time was needed for the temperature swabbing experiment so people could make sure they had everything to take part in the experiment (eg weighing scales, salt)
- Experiments need to be designed with a large degree of flexibility in terms of time and there should be no fixed dates. For example, Dani requested that the swabs for the detergents experiment being sent in on Monday on three consecutive weeks, but in practice this was not possible as people could not always fit in three washes per week or do the swabbing over the weekend, or get to the post office on Monday or Tuesday. This meant it is possible many of the swabs had 'died' before they reached Dani and not everyone completed the experiment.
- Experiment packs were sent out to people who did not complete the experiment (12 for temperature swabbing, 5 for detergents, 0 for temp washing)

Be careful in the demands you place on key volunteers

- We were contacted early in the project by a Dani Sharlot, a mature student studying microbiology (and a cloth nappy user). She had various ideas for applied microbiology experiments with cloth nappies and wanted to join forces. She got a lot of help with her experiments, and we got various microbiology tests done that would have been a lot more expensive at a commercial lab.
- It also fitted in very well with the volunteer-led ethos of the project, and Dani was a fully involved member of the group (in a way that bought-in lab services would not have been).
- However, this meant we did not have a contractual relationship with Dani, should anything go wrong. But a considerable amount of the experimental work was dependent on her.
- When Dani had health and family problems, some of the experimental work fell behind and we were all panicking a bit. And I think there was a considerable amount of strain on Dani.
- We sent her an Ocado delivery of ready meals, in order to help give her some free time. But due to security rules at her lab, that was as much help as we could offer.

More motivation than just 'participating in science' is needed as the experiments demanded significant commitments of time and effort

- As the 'temperature washing' experiment was taking so long (and each person could only start their part of the experiment once the previous person had finished), we instituted a prize of a book, for anyone who completed their washes within a week. This worked well.
- However, the condition should have included the time to do the experiment and post on the package as that was also causing significant time delays.
- We should have had prizes right from the beginning, and made the most of people's natural competitiveness by making more of the groups being in 'teams' (of each temperature condition). So, e.g., had a prize for the team that finished their washing first, so there would be peer pressure from the other members of the team.

You can't assume anyone has access to even the most basic equipment.

- Most people do not have a printer and so printing the label to send on the parcel for the temperature washing experiment became quite a big issue. Next time, we should find some way to get all labels printed in advance (not possible this time as some people needed a courier booking on a date which was not known at the start of the experiment, and labels for dropping off parcels would have expired by the time they were ready to be used in many cases with this courier company)
- One person did not have salt (for sterilising the swab) and was not able to get the salt in time to start the experiment on time. Another did not have scales

Presenting the science – one experiment will not give the answer.

- Sometimes the potential significance of the results were over-egged as part of encouraging people to complete the experiments and we were at risk of implying that definitive answers could be achieved from one experiment.

More repeats and a bigger sample size were needed.

- This was especially true for the temperature washing experiment where each type of nappy only got tested once at each temperature for each number of washes (and each of these experiments was done by a different person)
- There were very few people with soft water, and this combined with people dropping out meant that some of the detergents were not tested for medium water.

We should have had something to sign for participants before they started.

- We had some people drop out for unavoidable reasons (family illness, etc), but some people dropped out because they suddenly decided they didn't agree with our aims or the experiment, although these had not changed. ("Unfortunately I'm going to have to decline. I feel the experiments you are doing isn't actually going to produce helpful results as you can't possibly allow for all the variables - different machines, water hardness etc.") This was frustrating.
- Some experiments ask participants to sign something before they start, "I certify that I understand that I am signing up for X experiment, with Y aims, which will involve Z." They can still withdraw, of course, but it might help to make sure that people knew what they were signing up for. And be an opportunity to bring any issues to their attention.

Project Specific Problems

Two people should have checked through the contents of the experiment packs so that things weren't forgotten. For example:

- The person making up the experiment packs forgot to include the muslin bags for the soap nuts and these had to be sent on separately.
- The eco eggs were not packaged correctly, so people could tell if they were actually

testing the eco egg or using an empty shell for making the experiments blind from opening the experiment pack

Swabs got lost in the post

- Sending swabs via the post is easier said than done. Despite extensive research to make sure sending swabs of washed nappies in the post was allowed by Royal Mail, a significant number of swabs (about 10) did not reach Dani.

People had trouble with Google Forms

- 10+ people seemed to be having trouble with using google forms as part of the detergents experiment. It is possible that some of these were people who had not done what they said they would do, but there were definitely some who had done the form but it had not come through (not clear whether this was google forms itself or people not using it properly)
- Many people did not record their results on paper as well as on google forms, so many people who had to fill in their forms were doing it from memory several weeks after the experiment had taken place. This problem could have been mitigated if we had realised every person needed checking up on every step of the way earlier in the experiment.
- We could have had paper forms included in the packs, for people to fill in by hand at the time.
- It also made it harder to distinguish unlabelled swabs.

We should have had an inventory in the box of nappies for the temperature washing experiment. With pictures of each item.

- There was a lot of confusion about which bit went with which bit. Or which thing was what.
- Just because people are part of a community (in this case, using cloth nappies), doesn't mean they are a complete expert and know every nappy on the market. Communities are not homogeneous.
- Some nappies went missing (presumably mixed up with someone's own nappies), which might have been avoided with an inventory.

Tips from our citizen scientists

As part of our end-of-project feedback survey, we asked our members what advice *they* would give to another Citizen Science project.

The most common advice was to do a trial run of the experiment. (The project staff agree!)

"Do a trial run first to help iron out any unforeseens that we discovered in the trial, but that we were unable to do anything about at that stage."

"Run the experimental instructions past a larger group (perhaps the group testing?) to ensure all questions are asked at the start and to ensure all follow the same procedure throughout."

We hear you!

Make sure instructions are clear.

"Make the instructions water tight."

"The amount of people who didn't sound like they were following the basic instructions from the online threads would have driven me nuts!"

"Be clear about what measurements are required and how to record them."

Allow lots of time, and nag people.

"Allow more time for everything than you think. Be prepared for people not to agree with what you're doing or how."

"Make sure every one has seen/read the documents - I know I hadn't read the protocol and then had questions afterwards which must have been annoying"

"It seems you can never have enough time to chase well meaning people who intend to help but whose first priority may not be doing what you asked."

If there's something specific people need to know, reiterate it again and again.

"Also, if your want it to be blind, warn people before they get their packs - I excitedly opened mine, looked at everything and then read the note which said not to look at the detergents. Oops."

Realise the limitations of your format.

"It is hard to get things done online, feels a bit nebulous, when you have smalls in your life easy to put things off till tomorrow/next week, then their sleep goes to pot and a month has gone by."

Take steps to avoid people dropping out

"Make sure everyone knows what the experiments will entail before agreeing to avoid people dropping out."

Give them a paper form to fill in, not just online

"Access to a hard copy of the experiment measurements to be taken to allow easier collection of data."

And realise that most people won't have a clue what you are talking about.

"Explain what a citizen science project is often and keep repeating."

What did experts get out of it?

“Thanks for hosting this, it's been fantastic, and has helped me think through some ideas.”

As part of the project, we had weekly live chats with various experts. This was partly to inform the experiment planning (experts included: detergent experts, fabric testing experts, epidemiologists, nappy manufacturers), but we also talked to other scientists and experts who might be of interest to the cloth nappy community (a psychologist who studies 'disgust' and how it affects environmental behaviours, the author of a book on 'green parenting', an expert on child-led potty training) and scientists who were of general interest to parents of small children (a neuroscientist who studies infant sleep, a psychologist who studies joking and pretending in small children, child language development researchers).

These chats served several purposes:-

- To give the group access to specifically useful information for experiment planning.
- To give the group experience of talking to cutting edge scientists and researchers about things that were interesting or important to them. To see science being useful to them.
- To gather evidence-based parenting information from current researchers and make a repository of that online. So much parenting advice online is not evidence-based, and can be frankly dangerous.
- To give researchers and other experts a chance to talk directly to parents and hear their questions.

What did experts make of the experience?

100% of the experts who completed our post chat survey (26 out of 26) would take part again.

100% of the experts who completed our post chat survey (26 out of 26) would recommend the experience to a colleague.

The found it frenetic

'I was surprised how fast the time went!'

'Speed of interactions. Lots of questions and fast paced.'

Varied, enthusiastic, engaged

'The variety of questions- some really interesting stuff. Some that I knew how to answer straight away, and some that required a bit more thought.'

'The questions from the people taking part in the chat were really interesting and of a higher level than I was expecting. This was really interesting and it was great to be able to offer some insight based on our experience.'

'I was surprised how many questions there were! It was great to get so many insightful and thought provoking questions.'

'I expected it to be a useful opportunity to communicate some of our findings and tell people about how infancy research works, but I didn't expect it to be such fun! I think it worked particularly well because people knew our research backgrounds, so asked targeted questions. I'd do it again tomorrow!'

They found it a fertile experience

'I was (happily) surprised by the enthusiasm and creative thinking of the individuals I was chatting with, reinforcing the need, I think, for academics to engage with a range of people outside their immediate work environment in order to foster and think through important ideas.'

'It was a great experience. I feel like the questions from the public encouraged me to think about how to go forward with my research.'

'Thanks for hosting this, it's been fantastic, and has helped me think through some ideas.'

Appendix

Who took part?

At time of writing there were 1,097 members of the Facebook group. These include 'super-peers' in the cloth nappy community – for example, people who run nappy libraries, or who admin other cloth nappy groups – and also retailers and manufacturers. This gave us access to people who could answer various questions. And also meant we were quite plugged in to networks.

They ranged from people who's highest science qualification was at GCSE level, to science PhDs and post-doc researchers.

We had an initial survey which we encouraged people to fill in when they joined the group. 197 members have filled this in in total. For the sake of argument, we'll assume that these people are representative of the group as a whole.

They overwhelmingly use cloth nappies on their children (with some former users and some intending to use in future), either full or part-time.

Do you use cloth nappies?

Full-time user	62.94%
Part-time user	22.84%
Occasional user	2.54%
Previous user (child out of nappies)	7.61%
Previous user (child still in nappies)	0.51%
Thinking about it	3.05%
N/A	0.51%

They exhibit a cluster of behaviours that common prejudices might predict go with reusable nappies. (i.e., they are a bit hippy/attachment parenting)

Behaviour	'Yes' + 'sometimes' answers (%)	Would if applicable (%)	No. responses
Co-sleeping	82	-	194
Baby wearing	98	-	196
Vaccinating children	99	-	194
Used amber teething necklaces	27	3	192
Used cloth sanitary pads	48	11	195
Used washable breast pads	79	3	196
Used a Mooncup (or other menstrual cup)	46	5	19

But they are generally pro science (as one would perhaps expect, given that they've joined a group with science in the name) and their children are mostly vaccinated.

Respondents reported the following attitudes towards the given statements:

Statement	Strongly agree/agree	Strongly disagree/agree	No. responses
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	(%)	(%)	
I am able to make a contribution to science	82	5	194
Only fully qualified researchers can make a contribution to a science project	4	91	195
I am capable of being a 'scientist' in certain contexts	81	8	195
I wouldn't know where to start designing a scientific experiment	17	64	194
I am interested in science	94	1	195
Science answers questions that are relevant to me	87	4	195
I trust advice more if I think it has a scientific basis	82	3	195
I trust advice more if it is recommended by other parents	39	19	194

They were distributed across the UK



This map shows the distribution of people who volunteered to take part in the experiments. (As we haven't collected location data for anyone else) We know we also have members in the USA, various European countries and in Australia, but they weren't eligible to take part in experiments.

Summary of final survey responses

Q: What is your involvement with the cloth nappy community?

Respondents: 87

Involvement	No.	%
Cloth user	82	94.25
Member of preloved or discussion groups	48	55.17
Nappy retailer	5	5.75
Run or involved with a nappy library	17	19.54
Other	3	3.45

Q: How did you hear about NSG?

Respondents: 87

Response	No.	%
Post in another Facebook nappy group	60	68.97
BabyCentre cloth nappy board	4	4.60
Told by a friend	14	16.09
Saw in another Facebook (not nappy) group	3	3.45
Other	6	6.90

Q: What initially interested you about NSG?

Respondents: 87

Response	No.	%
The science!	73	83.91
Troubleshooting cloth nappy problems	57	65.52
Myth busting/getting scientific evidence	3	3.45
Sharing love for cloth	26	29.89
Just curious	35	40.23
Community aspect	16	18.39

Q: What did you like about NSG?

Respondents: 87

Category	No.	%
Finding factual, scientific answers/challenging myths	49	56.32
Live chats/getting answers from experts	27	31.03
Support/community feel/welcoming	35	40.23
Citizen science aspect	23	26.44
Learning new things	12	13.79
The experiments	16	18.39

Q: What did you dislike about it?

Reponses: 87

Lack of effort/focus at certain points	3	3.45
Disputes/hostility from some people	10	11.49
That it's ending/short timescale of project	13	14.94
Timing/platform of live chats	5	5.75
That it's a public group	2	2.30
Not being able to participate in the live events	2	2.30
Nothing	30	34.48
Other	21	24.14

(The large 'other' category is due to the specific/personal nature of some of the responses, e.g. I didn't like wet nappies or I didn't have time to contribute as much as I wanted).

Q: Did anything surprise you?

Respondents: 61

Response	No.	%
No (often qualified by statement that experiment results weren't yet available)	9	14.75
How many people got involved	6	9.84
How complicated questions and designing experiments can be	4	6.56
Time/input given by experts	6	9.84
Hostility from some quarters	2	3.28
Bio powder advice change	10	16.39
Differences between detergents	12	19.67
Lack of flushability of 'flushable' products	5	8.20
Other	14	22.95

Q: Tell us something you've learned (selected quotes)

- The difference between soap and surfactant
- That most people believe what they are doing is right and don't like to be told different.
- I now have a better understanding of how a washing machine gets stuff clean.
- That hard water affects the efficacy of detergent, and the effect of hard water generally past limescaling everything up. I now use water softeners routinely.
- That effective detergents grab dirt and hold it in suspension so it can be rinsed away instead of redeposited on the clothes.
- How to get my nappies clean without using so much water.
- That I want to take up studies in science! (Looking into it now)
- I've learnt what the ingredients on the detergent box actually mean and what they do
- That bio is ok to use on nappies - mine no longer smell!
- I learned how much work goes into conducting even the simplest of experiments.

Q: What for you was the most important part of the project?

Respondents: 87

Response	No.	%
Doing experiments	13	14.94
Chats	15	17.24
Finding out the results of the experiments	38	43.68
Discussion in the Facebook group	19	21.84

Other	2	2.30
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Q: Engagement with live chats

Behaviour	No. of respondents
Took part in a live chat	25
Found live chats informative	25
Read write ups of chats on blog	71
Found write ups useful	65

Q: Have you changed your washing routine in any way as a result of this project?

Total respondents: 87

Positive respondents: 58 (67%)

(Some negative respondents reported that they haven't made changes either because their current habits have been supported by group findings, or because they were waiting for results at the time of answering)

'Science words'

In both the initial survey and the end of project survey, we asked volunteers to come up with ten words they think of when they think of science. We wanted to see if taking part in a project like this would change people's answers (for example, does 'hard' in the first survey become, 'rewarding' in the second survey). The results are not as clear cut as we hoped, so we have not included them in the main report, but we include them here, for interest.

In the initial survey, 973 answers were counted. Words that have 5 or more occurrences make up the top 65% of the total number; the occurrences of these words were compared between the initial and final surveys. In the final survey, 783 answers were counted. The top 65% of answers (by number of answers) for this survey includes more individual words than the initial survey. The occurrences of the remainder of the top 65% of answers in the final survey were also compared to their occurrences in the initial survey.

Words marked with * are those that had several variations within the answers, e.g. lab, labs and laboratory, and have been grouped together.

Lab-based words

Words with 5 or more occurrences in the initial survey, compared to occurrences in the final survey:

	Initial		Final	
	Number	%	Number	%
experiment*	82	8.43	52	6.64
test	74	7.61	24	3.07
laboratory*	22	2.26	24	3.07
test-tubes	15	1.54	6	0.77
white-coats*	13	1.34	9	1.15
chemicals	13	1.34	7	0.89

Bunsen- burner	8	0.82	8	1.02
tubes	5	0.51	1	0.13
periodic table	7	0.72	3	0.38

Additional words in top 65% of final survey answers:

	Initial		Final	
	Number	%	Number	%
goggles	1	0.10	6	0.77
sample	1	0.10	5	0.64
swabs	0	0.00	5	0.64
atoms	3	0.31	3	0.38
bacteria	2	0.21	3	0.38
beaker	2	0.21	1	0.13
elements	3	0.31	2	0.26
cells	3	0.31	2	0.26
gases	0	0.00	2	0.26
microscope	2	0.21	2	0.26
molecule	0	0.00	2	0.26
petri dish	1	0.10	2	0.26
pH	0	0.00	1	0.13

(The increase in words such as molecules, swabs and samples could be a direct results of experiments and live chats).

Research-based words

Words with 5 or more occurrences in the initial survey, compared to occurrences in the final survey:

	Initial		Final	
	Number	%	Number	%
research	35	3.60	11	1.40
evidence	29	2.98	18	2.30
hypothesis	21	2.16	10	1.28
fact	17	1.75	8	1.02

theory	17	1.75	5	0.64
investigation*	13	1.34	4	0.51
learning	12	1.23	10	1.28
truth	11	1.13	4	0.51
discovery	10	1.03	9	1.15
proof	9	0.92	2	0.26
question*	9	0.92	9	1.15
data	8	0.82	6	0.77
control*	11	1.13	9	1.15
study	8	0.82	2	0.26
objective	8	0.82	0	0.00
logical	7	0.72	1	0.13
evidence-based	6	0.62	0	0.00
results	5	0.51	13	1.66
conclusions	5	0.51	5	0.64
information*	7	0.72	4	0.51
peer-review	5	0.51	1	0.13
answers	3	0.31	8	1.02
factual	2	0.21	5	0.64
knowledge	13	1.34	5	0.64

Increases in discovery, question, results, answers and conclusions suggest a direct influence of the release of NSG results.

Additional words in top 65% of final survey answers:

	Initial		Final	
	Number	%	Number	%
analysis	4	0.41	6	0.77
trial and error	0	0.00	4	0.51
technical	0	0.00	3	0.38
(critical)				
thinking	1	0.10	3	0.38
report	2	0.21	2	0.26
review	1	0.10	2	0.26

Increase in analysis, trial and error and thinking suggest a change in perception of what research involves.

School-based words

Words with 5 or more occurrences in the initial survey, compared to occurrences in the final survey:

	Initial		Final	
	Number	%	Number	%
school	12	1.23	11	1.40

Additional words in top 65% of final survey answers:

	Initial		Final	
	Number	%	Number	%
education*	1	0.10	4	0.51

Experience/feelings about science words

Words with 5 or more occurrences in the initial survey, compared to occurrences in the final survey:

	Initial		Final	
	Number	%	Number	%
interesting	21	2.16	16	2.04
fun	10	1.03	16	2.04
important	7	0.72	3	0.38
progress	6	0.62	1	0.13
clever	5	0.51	1	0.13
exploring*	5	0.51	1	0.13
reliable	5	0.51	2	0.26
work	5	0.51	2	0.26
understand*	5	0.51	5	0.64

Fun has doubled in proportion!

Additional words in top 65% of final survey answers:

Initial	Final
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	Number	%	Number	%
development	1	0.10	4	0.51
collaborative	0	0.00	3	0.38
discussion	0	0.00	3	0.38
future	1	0.10	3	0.38
exciting	4	0.41	7	0.89
rigorous	3	0.31	9	1.15
useful	3	0.31	5	0.64
relevant	0	0.00	4	0.51
challenge	0	0.00	3	0.38
ground-breaking	0	0.00	3	0.38
innovation	4	0.41	3	0.38
methodical	3	0.31	4	0.51
Nappy Science				
Gang	0	0.00	3	0.38
new	1	0.10	3	0.38
trust*	1	0.10	3	0.38
change*	2	0.21	6	0.77
complex	0	0.00	2	0.26
fascinating	2	0.21	2	0.26
focused	0	0.00	2	0.26
group	2	0.21	2	0.26
improvement	2	0.21	2	0.26
intriguing	0	0.00	2	0.26
method	3	0.31	3	0.38
professional	1	0.10	2	0.26

Exciting and rigorous have both increased considerably! The increases in/appearances of these words also suggest a shift-change in attitude towards science and how it's carried out, e.g. collaboration, discussion, challenge, useful and complexity are recognised.

People-based words

Words with 5 or more occurrences in the initial survey, compared to occurrences in the final survey:

Initial	Final
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	Number	%	Number	%
geeks	5	0.51	1	0.13

This is a decrease in mentions of a stereotyping word - suggests members are now seeing science as less exclusive and more for 'normal' people.

Additional words in top 65% of final survey answers:

	Initial		Final	
	Number	%	Number	%
people	1	0.102774923	3	0.383141762
scientist	2	0.205549846	3	0.383141762
professor	1	0.102774923	2	0.255427842

Increase in 'people' words suggests more association with real people?

Numerical words

Words with 5 or more occurrences in the initial survey, compared to occurrences in the final survey:

	Initial		Final	
	Number	%	Number	%
accuracy*	6	0.62	1	0.13
measurements*	5	0.51	4	0.51

Additional words in top 65% of final survey answers:

	Initial		Final	
	Number	%	Number	%
statistics	3	0.31	2	0.26

A suggestion that people are thinking more about experiences and concepts than hard numbers and data?

Subject-based words

Words with 5 or more occurrences in the initial survey, compared to occurrences in the final survey:

	Initial		Final	
	Number	%	Number	%
chemistry	27	2.774922919	15	1.915708812
physics	19	1.952723535	13	1.660280971
biology	30	3.083247688	15	1.915708812
maths	5	0.513874615	4	0.510855683

Additional words in top 65% of final survey answers:

None

In comparison to the Public Attitudes to Science report that says people are more likely to mention subject names than concepts such as ideas or a way of thinking, this suggests NSG has had an influence on people's perception of science.

Wider world words

Words with 5 or more occurrences in the initial survey, compared to occurrences in the final survey:

None

Additional words in top 65% of final survey answers:

	Initial		Final	
	Number	%	Number	%
space	4	0.41	4	0.51
nature	2	0.21	3	0.38
big	0	0.00	2	0.26
brain	1	0.10	2	0.26
everyday	1	0.10	2	0.26
history	0	0.00	2	0.26
medicine	4	0.41	2	0.26