
Volunteering in school science lessons: expectations and experiences of university students

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BACKGROUND

This study investigates university students studying engineering, science and ICT degrees and their experiences volunteering in a school-based science/maths outreach program. The aims of the program are to increase enthusiasm in science and maths in the middle years of education and promote science as a career choice. The volunteers support these aims by providing specialist knowledge and assistance to the class teacher, interacting with the school pupils and being role models. They are placed in a class for a ten week period during which they build relationships with the pupils and are encouraged to answer questions not only on the topics being studied in class, but also on their own experiences studying and their pathways to higher education. The benefits of this program to school students have been studied but the outcomes sought and experienced by the university students are less well known.

PURPOSE

To understand why students volunteer and what benefits they experience during their school placements.

DESIGN/METHOD

Volunteers were invited to take part in focus groups before and after their school placements. During the pre-placement focus group they were prompted to discuss their reasons for volunteering. In the post-placement session they were asked about why they had participated and asked to reflect on what they had gained from their experiences. The discussion was recorded and transcribed and the transcript coded to identify key themes.

RESULTS

Students volunteered for a variety of reasons with most students having more than one motivating factor. Reasons included altruism, enjoyment of science, a desire to develop confidence and public speaking skills, and to enhance their employability.

CONCLUSIONS

Volunteers participated in this school-based mentoring program for the expected motivational reasons described in the literature. After placements volunteers had improved their communication skills and reinforced their subject knowledge. This paper concludes that participation in this outreach program is of value to university students in terms of knowledge, skills and confidence gained but that they are often unaware of many of the skills they have demonstrated and developed.

KEYWORDS

Volunteering, school, science, mentoring

Introduction

The number of school students electing to study science and maths based subjects both in school and beyond is an ongoing source of concern (Office of the Chief Scientist, 2012). Studies such as “Sustaining Science” (Dobson, 2007) highlight the overall long-term decline in university enrolments in science degrees, while others highlight the decline in the selection of school science and maths subjects in high schools (Ainley, Kos, & Nicholas, 2008).

An important method of increasing interest in science is to provide young role models to pupils to dispel some of the myths surrounding the difficulty of science subjects, the lack of relevance in the school pupils’ lives, the elitism of universities and the social stigma often associated with studying science. Outreach programs of this type provide clear benefits to the school pupils in terms of increasing their interest and their attainment in science subjects, raising their aspirations in terms of education and making them aware of the many varied career pathways available to those with a science background (Harris & Calma, 2009). The benefit to a class teacher of having a scientist in the classroom is also clear with the teacher being supported in terms of specialist knowledge, additional ideas for activities and an extra set of hands and eyes in the classroom. The benefits experienced by volunteers in school outreach programs are less well known. University students have many pressures on them in terms of study workload, financial burdens and social expectations. Why do they choose to give up their time to go into schools and help younger students? It is known that volunteers bring passion and experience to the classroom (Beck et al., 2006) but what benefits do they gain in return? This study examines these questions for students volunteering in the In2science program.

Volunteer motivations have been studied in a variety of scenarios, and the volunteer functions inventory (VFI) offers one of the most comprehensive set of Likert scales tools for assessing peoples’ reasons for volunteering (Clary & Snyder, 1999; Clary et al., 1998). The authors classify motivations into six categories. These are:

- Values** - altruistic motivation
- Understanding** - learning and practising skills
- Enhancement** - increasing self-esteem
- Career** - gaining experience and creating opportunities
- Social** - forming and developing interpersonal relationships
- Protective** - escaping from negative situations and emotions

However this classification system is not exhaustive and it has been shown that more categories e.g. religiosity, enjoyment and team building can be identified when using open-ended probes as opposed to Likert scale investigative tools (Allison et al. 2002). Other researchers have argued that altruism is not a separate category but is intrinsically linked to all the other reasons for volunteering, as the same skills could be gained through other means (e.g. part-time work) and it is the combination of self-serving and altruistic benefits that make volunteering an attractive prospect (Burns et al., 2006).

There are several outreach programs currently running nationally in Australia and specifically in Victorian schools, each with its own specific goals. Programs such as Digital Divas and Robogals, which work in the fields of ICT and engineering respectively, focus on increasing participation and aspirations in these subjects among girls.

Robogals was founded, and is entirely run by, student volunteers. It targets girls in grade 5-7 with fun, educational workshops that aim to introduce “engineering” into the girls’ vocabulary, which is especially important as engineers do not often become school teachers (Robogals, 2012). The program started at Melbourne University but has grown nationally and internationally. There is no literature to date describing the benefits to the volunteers themselves.

The Digital Divas program, which is also run at Swinburne University of Technology (henceforth referred to as SUT), where this study is based, pays female ICT students to deliver content in structured sessions to female pupils in the early years of secondary education (grades 8-10). The benefits to the ICT students who participate, beyond pecuniary rewards, were stated to be “growth and empowerment” along with the enjoyment from watching the school students they worked with develop and begin to open up to them (Lang et al., 2010).

The nationwide “Scientists in schools” and “Mathematicians in schools” programs create and support long-term partnerships between scientists and mathematicians interested in engaging with local schools. On average the scientists visit their schools 1-3 times a term and the average partnership last for approximately eighteen months. The participants have enjoyed the opportunity to communicate with students, teachers and more broadly with the public. Many found a renewed satisfaction in their own careers and rated their confidence in communicating science as having improved (Rennie, 2012).

The In2science outreach program studied in this paper is an initiative involving multiple universities in Victoria working together to increase enthusiasm, attainment and aspirations in science and mathematics in the middle years of education, focussing on classes from grades 5 through to 10.

The program places university student volunteers in their second year or above of a science or maths related subject into local government schools for ten week placements where they work with one or two classes to build relationships with the pupils and teachers. The term used for the student volunteers is “peer mentors” as they are not there to teach or deliver specific content but rather to answer questions and be role models. Mentors are often not too far removed from the pupils in age compared to teachers or visiting scientists, though the program has no age limit and mature students are welcomed. Wherever possible the program places students at the school they themselves attended to further emphasise that higher education goals are achievable whatever the student background. As a cross-university, collaborative project In2Science has placed over 1600 mentors in more than 100 Victorian government schools since 2004 (In2science, 2011). Mentors spend 1-2 hours per week in the classroom, supporting the teacher by assisting with running science classes, conducting experiments, and providing insight into current scientific thinking.

A program wide evaluation is conducted at the end of each placement with online surveys being sent to peer mentors and teachers and hard copies given to school students. This is used to assess the running of the program and examines the mentor experience using 17 questions assessed on a five point Likert rating scale and four short answer text questions. This is useful for providing a snapshot of the mentor experience but does not examine their motivations and experiences in depth, which is the purpose of this study.

A more in depth program evaluation was carried out in 2005 (Farrell & Harris, 2006) which sent questionnaires to peer mentors and received 31 replies, a response rate of 50%, of which 20 were studying for a Bachelor of Science degree and 7 for a combined Bachelor of Science/Bachelor of Education. However not all respondents were volunteers (n=5) as at some institutions the In2science program has become a compulsory part of some courses, while at others, including SUT, participation is purely voluntary.

The evaluation identified gaining teaching experience, CV building and a desire to promote science as key motivations for joining the program. The report argues that the benefits experienced by mentors were strongly linked to their perceptions of having helped students with the most rewarding aspects of the program being watching the students have what is quoted as an “‘Oh I get it now’ moment”. Participation also appeared to act as a means of trialling teaching as a career with some students finding it reinforced their desire to pursue, or not pursue, teaching as a profession and others finding spending time in a classroom caused them to revise their previous intentions in both directions. This evaluation suggested that

mentors have a variety of different motivations for volunteering and the evidence of altered career aspirations suggests they do not always find the placement to be what they expected.

SUT, where this research was conducted, joined In2science in 2010 and at the time of writing had run two rounds of placements. SUT has no central science faculty, so students were recruited from three separate Faculties: Engineering and Industrial Sciences; Life and Social Sciences; and Information and Communication Technologies. All volunteers met with the coordinator and underwent training before being placed. There were no specific criteria used to select mentors and those who trained and provided their available times were offered placements.

In this paper we will use the word “science” to include all branches of science, technology, engineering and mathematics often referred to as STEM.

Methods

Focus groups were chosen as the method of data collection as they provided the participants with the opportunity to compare and contrast their experiences and to generate and explore their own questions within the context of a moderated discussion. It also contrasted with the existing formal evaluations of the In2Science program, which use structured questionnaires with predominantly Likert scale responses. Here open-ended questions were used to make it possible to identify motivations and benefits that not been anticipated by the researchers.

The ten trained mentors were invited to participate in an optional focus group to discuss their reasons for volunteering for In2science and their expectations of the program. Three replied and subsequently took part in the focus group session at the start of semester 1, 2012. The facilitator, who was external to the In2science program, was provided with the following questions to guide the pre-placement focus group discussion:

1. Why did you volunteer for a school mentoring program?
2. What are your perceptions of the program?
3. What (if any) skills do you hope to gain/improve?
4. Do you have any concerns or worries about your upcoming placement?

The thirteen mentors who had just completed their first placement were also invited to participate in a focus group. This was a different cohort of students to the pre-placement group so the responses cannot be directly compared between groups by comparing the views of the same mentor before and after placement. Comparisons will be made between the groups as a whole. Six students replied to the invitation and took part in the focus group, conducted at the end of semester 2, 2011.

The questions used to guide the discussion in the post-placement group were:

1. What was your motivation for volunteering in school science/maths lessons?
2. What did you expect to learn as a mentor?
3. What have you learnt from your experiences?
4. How have you changed / what other benefits have you gained?
5. How could we have helped to prepare you for this experience?

The focus groups were recorded digitally and transcribed. All names and locations were removed during transcription to ensure the ethical obligation of anonymity was met. Thematic analysis of the data was undertaken with two separate researchers coding the transcripts until they reached agreement on the themes identified.

Results and Discussion

Within the small sample of mentors who took part in the focus groups there were myriad reasons to volunteer and the mentors had widely difference experiences, even when placed within the same school. The only clear difference between the pre and post-placement groups was in their perceptions of secondary schools. The pre-placement group held more idealistic views compared to those who had already spent time in schools. The latter were very critical of what they observed and found it differed greatly from their own school experiences. They commented on issues such as large class sizes, discipline issues, the stress of tests and exams, and the overloading of teaching staff.

Both groups talked about common themes when asked why they volunteered for the In2science program. Motivations and experiences were coded into five main themes, with most mentors citing more than one reason for volunteering and spanning two or more of the categories. The themes identified in both pre and post-placement group transcripts and number of mentors mentioning each are shown in Table 1.

Table 1: Themes identified by mentors and the number of mentors who mentioned each theme.

Themes	Description	Frequency	
		Pre (n=3)	Post (n=6)
Career	to enhance their resume, considering teaching as a career	1	3
Learning	to develop skills, cement their own knowledge through explanation	2	6
Altruism	the intrinsic value of volunteering, benefits to society of more scientists, personal reward from helping struggling school students	2	3
Interest	for fun, something different	1	1
Science	a desire to share their passion for their subject, to show that science is fun	1	2

Careers - Only one post-placement mentor cited resume building as the sole purpose for their participation.

"I was there for, once again, a tick in the box which is really important as we're all getting towards the end of that degree.....Volunteer work inside schools looking after kids is highly regarded throughout most grad places I believe"

Most considered resume building as merely a component of their reasons for giving up their time e.g.

Post-placement *"I thought it would be something of interest. Not only that, I could put on my CV as well"*

Pre-placement *"It's not just necessarily going, "oh, cool, I've done this, put it on my CV" ... I wouldn't be doing it if it wasn't rewarding to me"*

Pre-placement *"I think it might be rewarding personally...I've been trying to volunteer and do certain things like donating to charities. I work with Engineers Without Borders doing things with them. It's something that I want to give back to someone."*

This last engineering student volunteered in several ways, but all within the scope of his academic background, perhaps because these are the skills he has which he feels are most useful, or perhaps they are volunteering experiences which also serve to make him more attractive to potential employers. In either case there is a dual motivation linked to both altruism and improving career prospects.

Volunteering in schools also provided an opportunity to "road-test" teaching as a career, a motivation described by members of both the pre and post-placement groups. The one

mentor in the post-placement group who had this as his primary motivation found that his experience in school had put him off teaching.

Post -placement *"After doing this I won't go into teaching ... because I can't teach in an environment where the kids have to be there, they don't want to do anything and there's nothing I can do just to even encourage them."*

This is consistent with the results of Harris et al. (2006) who found that placements could influence mentors both towards and away from pursuing teaching careers. This is a useful outcome for a student who may otherwise invest time in training to teach which would ultimately not be worthwhile.

Learning - Linked to career motivation is the motivation of learning, which encompasses knowledge and skills sought and developed during time in schools. Learning itself fell into one of three categories: subject knowledge, communication skills and professional skills.

Subject knowledge could be learned explicitly from spending time in classes that were not within the mentors' specialty. A pre-placement mentor said:

"I'm specialising in mechatronics which is electrical and mechanical. I don't know anything about chemistry; I don't know anything about biology. So I could learn something out of this."

Alternatively the mentors' own learning could be aided by the process of explaining their work to others. For example a post-placement mentor said:

"It's also nice to talk about what you've just learnt ...to reinforce that the ideas in your head are actually correct, so you can go I know this because blah, blah, blah and then they can go oh, well what about this and you go no this is blah, blah, blah."

Spending time in school also provided an opportunity for post-placement mentors to reflect on their own learning.

"It's almost part of the process; we just keep going up and up and up and I keep thinking have I learnt a bloody thing? I've been here for nearly four years and I'm not sure that I've learnt anything. But you forget what other people don't know."

Time in school also offered a chance for personal reflection for one pre-placement mentor.

"I just kind of thought maybe going back into a school – because I left school early and I thought maybe going back to that environment would give me a different perspective on things."

The most common reason given for participation was to develop communication skills, both in terms of gaining confidence talking in front of people and practicing adapting content and delivery to be audience appropriate.

Pre-placement *"If you haven't had much experience before...you can subconsciously talk down to them."*

Post-placement *"It's a skill which I could then take into oral presentations for uni"*

Post-placement *"So to be able to express things in a way that ... the younger kids could understand. Because you get very used to using technical talk and if you do that too much with the little kids they just sort of glaze over."*

Post-placement *"I could be creative in the way I got things through to people"*

Post-placement *"I think my communication... was really not that good before, but then I think it did really improve with the program, getting practice talking."*

None of the mentors mentioned employability as something that would benefit from their development of their communication skills, seeing the skills either in more general terms or as something that would help within the context of their degree. This was also true in the

case of professional skills that the mentors in the post-placement group did not always seem aware they had learnt and demonstrated. They had dealt with many issues during their placements such as time-management, dealing with conflict, and building trust. Though they did not explicitly recognise these as professional skills they described many examples of their application in situations such as dealing with substitute teachers and rude, unmotivated students.

“A lot of people I know haven’t done any work, they’ve just gone to school and uni, and that’s a skill that they could take on, like being professional even when there’s people you disagree with.”

“The normal teacher went away so there was a fill in...she was very disoriented and disorganised...so I was just going around ... asking them if they needed help.”

“The girls at the back were completely disengaged...drawing on each other’s arms. I said ‘well, I’ll give you some history about this sort of stuff’....It was quite funny actually, bang all the eyes were looking at me.”

“Some of them are not very open to being helped so they just say no I don’t want anything...if you suggest some things they would listen.”

Several mentioned fitting their placements around their studies as an issue and had to ask teachers what subjects they would be helping with in advance to ensure they had time to plan ahead.

‘You talked to the teachers and everything, but if you had some idea of what they were going to be working on beforehand, because by the time you actually get into school...you were quite busy with your own workload at uni.’

Altruism - Several mentors mentioned creating a better science learning experience for younger students as their motivation as they felt they lacked inspiration in their own education.

Pre-placement *“If someone had come in and said ‘Hey, cool, this is where this is used in real life’- I would have been like ‘oh, that’s interesting’ instead of just doing nothing in the back of the class and burning matches’.”*

The personal reward from helping others was also a key theme mentioned by post-placement mentors, corresponding to the “Oh, I get it now!” reward (Farrell & Harris, 2006).

“There’s a smile on their faces is just – because like they need someone to tell them oh, you’re doing the right thing ... that’s why it makes you happy”

“In the end you’re doing it because you try to, like the result; ... somebody has actually improved somehow or got better or got more confident, whatever it might be.”

The benefits of volunteering also go beyond helping individuals to aiding society as a whole by encouraging more people to become scientists. One pre-placement mentor said:

“It was just to make science a little bit more fun for the students because nowadays ... they’re starting to think that science is boring, so we are trying to make it a little bit more interesting for them so that they can actually go into that field later on.”

Interest - Some students volunteered for the simple fact that they thought it would be “fun” or “something different”, with one saying “I think it might be good to just drop to child level for a couple of hours a week and just de-stress”.

Science - Some mentors were motivated by a passion for their subject and a desire to pass that onto others.

Pre-placement *“I really like science, especially physics and how everything fits together and I think a lot of kids don’t get that in school. It depends a lot on the teacher and everything, but I’d like to be able to show them some of that.”*

Comparison to literature

The themes identified by the coders in this research complemented those described by Clary et al. (1998) with what has been here called altruism corresponding to what they labelled “values”, learning to “understanding” and “enhancement”, with “career” being common to both sets of descriptors. Though there was no specific evidence of the “protective” category in this data set, the first author has evidence of this motivation from conversations with other mentors and coordinators, though it is rare compared to the other motivations described here. Making social connections was also not explicitly mentioned in this data but the mentors describe gaining experience communicating in different ways, and they acknowledge the importance and satisfaction of building relationships over the duration of the placement.

“As you engage further and further, week to week they would get to recognise you and understand what you’re about, and they might actually find you interesting”

In addition there was the subject specific reason, categorised here as “science”, which can be seen as fitting partly within the categories of learning, altruism and career. It appears the multiplicity of benefits from the program motivates students to volunteer, rather than one dominant factor.

Conclusions

Volunteers participated in this school-based mentoring program for several motivational reasons which complement those described in the literature. The main reasons linked to career, learning, altruism, science and interest. After placements the students were more critical of the science education system and one participant was no longer considering a career in teaching. Overall the mentors found the experience had improved their communication skills, reinforced their subject knowledge and was personally rewarding. The program is therefore valuable, not only to schools but also to Universities in terms of providing opportunities to students to develop key skills and should be continued and expanded.

Though CV/resume building was often cited as a contributory motivation, apart from communication skills, there is little evidence of mentors understanding how the program advanced their skills and how potential employers would value this. Post-placement students demonstrated evidence of learning many professional skills such as time management and working with others though when asked how they had developed they did not mention these skills. This could be because they do not see these as useful and therefore not worth mentioning, or it may be that they do not realise quite how much they have achieved and its usefulness, e.g. in the workplace or in job interviews. Future work could investigate the use of guided reflection throughout the placement to assist students in examining their development. This work also suggests that a debrief session at the conclusion of placements may be beneficial to volunteers to discuss the skills they have demonstrated and how to incorporate those into examples that can be used in resumes and interviews.

Though it is acknowledged that the study was limited to small groups, even with these numbers the themes that appeared were found in both groups. Larger samples may find more reasons that maybe unique to individuals but the common themes are expected to remain the same. Future work will continue to investigate the experiences of mentors placed in schools.

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Acknowledgements

The authors would like to acknowledge the support of the ESER group at Swinburne University and all those involved in the In2science program. This work was funded through a Swinburne University of Technology Faculty of ICT Education Grant.

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