

Review of Technological Integration into Public Health Education

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ABSTRACT

This paper will discuss the milk donation environment within which an educational app could be introduced. Health literacy is important for upliftment and development, hence the crux of the paper will hone in on how technology has been utilized effectively in the public health care education sector. Persuasive methods, such as gamification and other techniques are analyzed on how they have been used to motivate, encourage and trigger user participation. More importantly such tools promote commitment to the lesson at hand. This is an evaluation of technological aids for education in the public health sector, which could be utilized in an app for milk donor education.

Keywords

Milk donation; Public health education; persuasion; gamification; technology; teaching aids; app development.

1. INTRODUCTION

The advancement of technology has led to an increased use of it as an aid for education, persuasion and motivation. This has been vastly beneficial within the public health care sector, where there is a lack of health literacy resulting in unnecessary illness or even death. There are many cases that demonstrate how the introduction of a technological aid has improved adoption of certain health practices and retention of knowledge previously discarded. These will be discussed further in section 3.

Technology has been used to motivate and persuade users to learn new information as well as practice it beyond the classroom. This is an important milestone in areas, such as India [7], Lesotho [17] and even Cape Town [12] townships where culture, myths and tradition is placed above health education (i.e. women are more inclined to listen and obey their husband on child birth than experts in the field). This can also be a demotivating factor for the people doing the teaching, and technology has been a huge motivator for them to continue with their practice and persuade others to follow suit [Kumar et al. 2015]

The art of digital persuasion is an extensively researched area. By identifying with a users' personality, they can be convinced to act a certain way [Ramachandran and Canny 2008]. Triggers, such as alerts, messages and reminders are also very powerful combined with the use of gamification, which will be discussed in section 4.

The main focus of the paper is to evaluate relevant tools and techniques that fit into the unique context of a milk donation education app with regards to breast milk donation linked to a charity. Currently there is extensive research and effort put into the promotion of such donation and the introduction of technology, like social networking or pasteurization devices, have increased donation rate [Ryan et al. 2002]. This idea will be explored through a number of case studies written on the area of education and persuasion, which lend themselves to the development of such an app.

2. MILK DONATION

Reasons for women not being able to feed their own child may stem from lactation problems, pre-mature babies, adopted babies, babies not latching or the mother having some disease, like HIV, or taking pills that could harm the infant. Many of the above reasons prevent the mother's ability to feed her own baby human milk. In case of the former, mothers may resort to alternative solutions like formula or donated milk (from a milk bank or peer-to-peer exchange).

In 2012 the American Academy of Pediatrics (AAP) warned mothers against using formula in a statement expressing that human milk is the best source of nutrients for an infant [AAP 2012]. Human milk promotes growth, development and works to boost the immune system against disease [Oddy 2002]. Babies not brought up on human milk are more likely to fall ill and succumb to sickness. This opposes one of the United Nations (UN) sustainable development goals, which is to ensure healthy lives and promote well being for all at all ages [United Nations 2016]. Therefore if mothers can access donated milk over formula they should.

2.1 Why Donate

Alternately, mothers unable to feed their own baby can turn to milk banks or peer-to-peer exchange of milk. According to Pimenteira Thomaz et al. [2008] and Gribble [2014] mothers are most inclined to give up their excess breast milk from altruism. Mothers feel a sense of social responsibility and often imagine a scenario whereby they may be a mother in need of milk rather than the mother donating it. In Brazil mothers donate milk in response to an authoritative figure, like a health professional [Thomaz et al. 2008]. Elsewhere, women are afraid of their milk running out and tend to pump excess. They do not want to see leftover milk poured down the drain and wasted, so donation is an attractive alternative. Excess milk also comes from mothers who pump because they work all day and still want their child to be fed breast milk even when they are separated.

Some mothers respond better to financial compensatory incentives, but this is discouraged as these women tend to underfeed their own child, or give them formula instead and sell all their milk for money [Shaw 2010]. As a substitute they add water to their expressed milk, to sell a larger quantity, which completely spoils the usefulness and purity of the milk [Bernardo and Cesar 2013].

Perrin et al. [2014] has illustrated that women, particularly those donating their milk online respond more to information on the recipient reasons for needing milk, and similarly recipient mothers want to know more about the background of the donor willing to give their baby milk. The more information or reasons given, the more likely women are to express further or push to express extra milk than they usually would attempt. Personal details are something milk banks in South Africa can't give out [POPI Act

No. 4, 2013], which brings to light an interesting dilemma. How do you motivate milk donation without recipient information? A mobile-phone-based application targeting milk donors could possibly introduce a more persuasive element by sharing more common reasons breast milk is needed. Then praising donors more regularly, emphasizing how invaluable they are in feeding recipient babies.

Current practice for an organization like Milk Matters [Milk Matters 2016] is to send an email or postcard to mothers after every 3L they donate. This will thank them for their contribution and inform them how many babies they helped to feed. The system can be problematic as mothers take a long time to reach that mark and they aren't receiving any feedback during the donation process, which could be months long, to motivate or educate them.

2.2 Milk Banks

Milk donation to Milk banks has played a substantial role in supporting the aforementioned sustainable development goal, as premature and immunized infants in hospitals are given human breast milk donated to organizations like Milk Matters [Milk Matters 2016], the Human Milk Banking Association of North America [hmbana 2016] and Ithemba Lethu [Ithemba Lethu 2015].

Mothers can donate directly to the hospital or recipient. However, these organizations take great care in donor selection and how the milk is pasteurized [Palmquist and Doehler 2015]. Pasteurization is the purifying of Mothers Own Milk (MOM) through heat, ridding it of any disease and impurities while still retaining the nutritional value. The milk banks also provide supplementary information in pamphlets or FAQ sheets, explaining to donors how the pumping and broader donation process works (donor screening, each pump of MOM goes into a separate bottle and how to drop off milk at a depot) and advising mothers on how much they should be giving. Reminding and reassuring them not to neglect feeding of their own child is also an important role of the milk bank. Despite the informative nature of this information, improvements could be made upon the process of distributing the knowledge and how mothers are educated, possibly through the assistance of technological aids and persuasive methods [Ramachandran et al. 2008].

2.3 Milk donation aided by technology

2.3.1 Peer-to-peer milk donation

From the increase in social networking and online social services such as Facebook, the practice of peer-to-peer donation has become more popular while donation to milk banks, like those mentioned above, has become a less common platform for donation [Perrin et al. 2016]. Mothers who have been turned away from milk banks, are too far from depots or have incorrect beliefs about the nature of these banks turn to social networks as a platform to sell or donate their excess milk [Gribble 2013].

Online donors, using sites like Human Milk for Human Babies¹ and Facebook groups such as Eats on Feets², have the ability not afforded to them by milk banks to get in touch with their

recipient. Following the initial online connection, usually resulting from a general request from either side explaining their reason, a pickup location and date is arranged. Sometimes mailing is preferred. If physical collection is arranged, mothers get to actually meet one another, and judge in person the sanitariness of the milk.

2.3.2 Milk pasteurization devices

The development of affordable milk pasteurization devices, such as an ODK sensor [Chaudhri et al. 2013] or using cellphone technology for flash-heating [Chaudhri et al. 2011], have made the process of peer-to-peer donation a lot more viable process. Recipients can pasteurize their milk affordably in their home using either of the aforementioned devices which both utilize the idea of flash heating (raising the temperature to 72°C for a short period of time and then waiting for it to cool down). This should rid the milk of any pathogens (like the HIV virus) while still maintaining its nutritional content [Bernardo and Cesar 2013].

However there is no guarantee in a peer-to-peer exchange that pasteurizing the milk using this technology is successful. Mothers are putting their children in danger of pathogens, disease and unhygienic milk [WHO collaborative study team 2000]. With exclusive use of milk banks, mothers have the assurance the Mothers Own Milk they choose to feed their child has been purified correctly. This is a motivating point organizations like Milk Matters may stress, to convince donors to use their service and not resort to unsafe practice that could potentially harm their infants. An app could be used fill this gap in donor knowledge and educate them on the risks. Health literacy is a strong reinforcement to prevent health risks. This topic will be embellished on in the next section.

3. PUBLIC HEALTH EDUCATION

It is well known that education is a strong influencer for better health practice [Windsor et al. 1993]. There have been many case studies on the subject, whereby general health guidelines are demonstrated to illiterate and unknowledgeable humans, particularly in rural areas [Nutbeam 2000]. There is a clear link between education and improved health. Presented knowledge from an authoritative source in an informative, persuasive and motivating manner makes users more likely to change their lifestyle to adopt newer practices. Health education has been used a great deal to reinforce good habits, safety and correct procedures as well as alleviating any misguiding myths or beliefs users had about health [Nutbeam 2008]. The introduction of technology in the field of health education has only enhanced these existing ideals, and will be discussed in more detail in the next section.

3.1 Public health education case studies

There have been a number of programs instituted around the world, targeting public health education in rural areas using technology. There are numerous tools and methods utilized in these studies, giving a broad indication of common practice currently used. These could apply within the context of an education app for Milk donation education application with technology.

3.1.1 Educational videos

The use of educational videos is a very common practice. In India [Kumar et al. 2015] and Lesotho [Molapo and Marsden 2013] it has shown to be fairly successful, especially for low-literate users who previously struggled to use primarily text-based educational materials on paper. Common practice has been to incorporate locals in the informative videos, giving them a “celebrity” appeal

¹ 2016. Human Milk 4 Human Babies. *Human Milk 4 Human Babies*.

² 2010. Eats on Feets. Available online: https://www.facebook.com/EatsOnFeetsHome/info/?tab=page_info (Accessed on 28th April 2016)

in the area. It also means they are more likely to be adopters of the recorded practice. In certain cultures, as shown by Kumar et al. [2015], movies form a big part of their normal lives, and even though the videos are educational, they can be filmed in such a way to appear Bollywood-like as well as highlight features of the environment filming is performed in. This increases the adoption of these films as well as the volunteer actors who want to participate. Town mayors invite recording, wanting their municipality showcased in a video. Culture has also been incorporated through songs used in the videos, reiterating the health message. This makes them catchy and gives a more fun angle to the learning process.

Testimonial videos are also very strong educational tools, as illustrated by Molapo and Marsden [2013] in Lesotho and in India by Ramachandran et al. [2010]. They have become strong motivators for health workers who previously felt demotivated and unimportant, even shunned by society. Testimonials starring well-known figures work as a strong persuasive method towards users who are more willing to follow the convention themselves after given their peers approval.

Videos are also good aids in group or individual meetings/consultations [Gandhi et al. 2007]. They introduce the topic in an effectively comprehensible manner. A well shot and edited video would include points for discussion. These could take the form of questions on parts of the video previously viewed. Interaction is a useful tool for learning and persuasion, which will be discussed later in the paper.

Furthermore, as in Lesotho [Molapo and Marsden 2013], users were afforded the option of recording their own content and sharing it. This improved their personal health literacy, as they had to grapple with the content for their upload. This extension was an influential means for them to convince their peers or share their views on additional health benefits certain practices have given them (not discussed in the original video).

3.1.2 Educational diagrams/pictures

Explanatory diagrams can be sent or shared between mobile devices, similar to the sharing of physical posters. Voice-overs in many different languages can be added to explain the content to illiterate users. These diagrams are easy to share with patients over Bluetooth or simply via flash drive.

Health workers have commented that through explaining and reviewing the pictures/diagrams repeatedly, they have learnt the ideals much faster than they normally would after a word-of-mouth lesson. The diagrams also aid as a reminder of information previously forgotten, before technology was introduced [Kumar et al. 2015].

3.1.3 Persuasive voice notes

Elsewhere persuasion techniques will be discussed, but it should be mentioned that an effective method to encourage user response is to give the technological device a more human-like tone/characteristic [Ramachandran and Canny 2008]. A device that comes across in a similar way to the dialogue user's are familiar with, can be effective. Instructional advice and audio notes replicated in a conversational manner can be used instead of lecture-style training. Users tend to identify and align with the device quite easily as shown by Ramachandran et al. [2010], even if they are unwilling to respond. Ramachandran et al. [2010] took on the task of debunking common, unhealthy myths in favor of educating users on better health practice. The interface "talked" to the user and reassured them of the falsity of common beliefs in a sensitive, informative way. Users responded a lot better to this

approach than lecture-style education on new practices, or told straightforwardly that their belief was incorrect.

3.2 Reservations and Challenges

There are a lot of obstacles in the field of public health education. People can be resistant to change, used to certain practices that have been in their culture for decades. Authority also comes into play and in a lot of cultures health protocols are dictated by elders (grandmothers) or the men (husbands of the mother). Simultaneously educating them, while educating the intended user could improve adoption of a new health practice as well as make the application more inclusive to the family unit instead of just for the mother.

Technology itself can also become a problem, as consideration should be made towards users unfamiliar or afraid of technology and those who don't own their own devices, resorting to borrowing other peoples. This can be particularly challenging to overcome when wanting to incorporate technology as a teaching aid and brings to light the idea of an intermediary, which was used in Katule et al. [2016] project for weight loss. Herein the younger generation where recruited to use motivating factors from the app to help their elders, as well as gain personal reward when they themselves used the app. The younger intermediaries were more familiar with the technology and worked to bridge the gap between the intended users who had little knowledge on the device. In this manner, technology can be used effectively.

4. TECHNOLOGICAL PERSUASION

Technology has been introduced as a strong medium upon which to promote public health education. It can be very effective, motivating, persuasive and informative if the right tools and techniques are used. There has been a lot of research on the subject, but only those relevant to a donor motivational and educational health app will be covered in this section.

4.1 Tools and techniques

As discussed earlier, donors respond to explanations of where their milk is going and why it was needed. This can be utilized through a technique discussed by Fogg [2002], where technological devices are given a more human-like characteristic. The manner in which a technological device states information and conveys instructions to the user tend to be more persuasive if done in a dialogue that is more familiar to the user. A more human feel. I.e. "Press play to watch video" vs. "Hi Melissa, if you would like to watch a video on using a breast pump, press play. It is super informative", encourages a user to interact and respond positively towards the technology.

Similarly, users respond to technology that offers them something useful, they want to return the favor and give something back. I.e. An educational app for mothers, that gives out invaluable, helpful information, the mothers using it are more likely to donate their extra milk in return if asked. Or at least the mother should be more inclined to look at the donation process, whereas before she would not have considered it.

Implementing a well-timed trigger, like a reminder for the user to finish watching a video, or drop of milk at a depot, help to persuade a donor to perform when before no action goes unnoticed [Fogg 2009]. However, the trigger is only effective when the user has the ability to perform the action. There is also a very thin line between being helpful and becoming annoying. Prototyping and live demonstrations are an important tool to figure out what those lines are.

Ramachandran and Canny [2008] bring up the well-known concept, less is more. They explore the idea of users presented with self-tailored, concise information in place of lecture-style information, which presents all available data. Users reacted more favorably to tailored information and likewise an educational app should consider the type of user utilizing the service and their individualistic searches, when conveying data effectively.

4.2 Gamification

Gamification is a technique that can be used a number of ways to encourage and motivate a user, not only in the traditional gaming sense. Gamification has been incorporated more frequently in applications, to achieve certain user involvement [McCallum 2012]. Gamification works to motivate users with the prospect of winning badges and seeing their status increase as they achieve certain goals/objectives. It promotes competition as users share their scores and compete against friends. Gamification also allows users to track their progress and review when and how they met certain goals [McCallum 2012].

For educational purposes, instead of the app giving users praise, like a congratulation message, for each educational video they watch, they can receive a badge indicating what expert level they are at. An element of competition can be used to see how many badges user friends have, to motivate them to watch more whilst improving their general health literacy [Katule et al. 2016].

Katule's [2016] reward system went beyond badges, and a more visual accolade was given each time, like items for the users virtual garden or food to grow their fish. Because milk donation is done with mothers, maybe an App with gamification for them could include building a nursery for their child, and with more lessons they learn, the more items they receive to furnish it. Gamification would work well as a means of motivation and persuasion for mothers rather than any harmful competitiveness and rivalry with regards to donating.

5. DISCUSSION

This paper has given a broad overview of the way technology has been used in public health education as a persuasive, informative resource. The tools used to achieve this have also been discussed. Maternal education has been evaluated, however there is a shortage of research into using it for donor mothers on how to feed, latch and pump for encouragement. This is where the project comes in, to fill this gap, which is so desperately needed (as per the Sustainable Development goals). More mothers need motivation to choose milk banks before resorting to peer-to-peer exchange, which could end up harming their child.

Hence the application will fill the roll of teacher to mothers on techniques as well as motivation for mothers to donate, by explaining the necessary reasons for needing the milk and where it will be going. Persuasive techniques and gamification will play a big part in getting user buy-in.

As shown throughout this paper, consideration will have to be taken in a rural context and application of the app. Even if it will not initially be targeted towards these areas, the teachings and lessons learnt from the above readings are invaluable towards developing any kind of app.

6. CONCLUSION

Human milk is vital to the health and survival of infants. Without the practice of milk donation many more babies would fall ill and not be able to fight the disease. Milk donation has helped many mothers who are unable to feed their children and the reason milk banks are encouraged is because of their safety, more reliable

nature, hygienic practice and consistency. But further motivation and public health education is needed to convert and convince more mothers to firstly donate and secondly donate to milk banks over peer-to-peer exchange.

Therefore, like education through technology has been used other project motivate and persuade users to change their unhealthy habits, the intervention of a technological aid is crucial to increase the future success of milk banks like Milk Matters.

Persuasion and motivation can be achieved a number of ways, most recently the idea of gamification has become significantly popular. In light of all the case studies mentioned above, the most effective way to approach donor motivation and persuasion would be to introduce an educational technology app incorporating techniques like gamification. Donors should be rewarded and motivated when they attain value/education from the app and in return want to donate their excess milk. This would be the ideal outcome of an application of this nature. There will be numerous challenges like those discussed above, but knowledge of them should help to overcome obstacles and create something worthwhile.

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