Google GLASS within education

David Costolloe

David completed his Master of Teaching in 2015, with methods of Geography and General Science. Before this he worked as a geologist in Western Australia since 2006, a role which needed practical skills within a variety of information systems, which he is looking to bring with him into his new role as an educator.

The possibilities and problems of the use of Google Glass within education

Google Glass, or just simply Glass, is a relatively new piece of wearable technology first released on a trial basis in April 2013. Glass is worn on the users head, with a small single screen display for one eye (see Figure 1) that appears around 25 inches is size to the user, and connecting via Wi-Fi to the internet (Borthwick, Anderson, Finsness, & Foulger, 2015). Glass's hardware and broad range of ever expanding programs bring together multiple forms of technology in an effort to link people to the digital world, in a fashion remarkably similar to the famous robot vision in the classic movie series 'Terminator' (see Figures 2 and 3) with the user seeing a digital layer on top of the real world (Strain, 2013).

The possibilities for Glass within education were immediately apparent to educators and educational organisations, with many participating within Google's initial 'Explorer' program so as to discover its potential (Nield, 2015; Otane 2013). This program allowed for a limited amount of units to be bought and used for $1500 USD, however only after the applicants passed an interview process designed to allow only those with beleifs in line with Google's famous “Don't be evil” motto to introduce Glass to the public at large through their own usage (Paterson & Glass, 2015). Individuals or organisation who received the product have since been allowed to experiment

Figure 1: The beta version of 'Google Glass' from the 2013-2015 'Google Explorer' program. Retrieved from http://discovermagazine.com

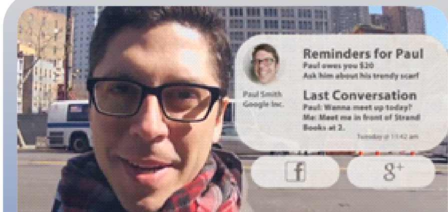

Figure 2: A representation of one of the multiple functions of Glass's heads-up display. Retrieved from http://www.techrepublic.com

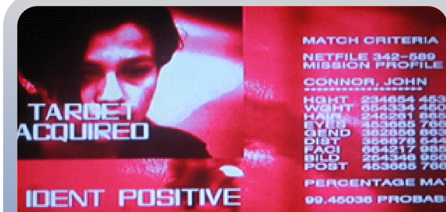

Figure 3: One of the multiple functions of Skynet's fictional anti-hero, the Terminator. Cameron, J. (Producer & Director). (1991). Terminator 2: Judgment Day [Film] Los Angeles: TrsiStar Pictures.

with Glass, creating their own freeware applications, whilst providing feedback to Google.

As to the trials of Glass within an educational setting, by and large all have provided positive feedback accross a range of areas, with a noted increase in engagement of students both in the use of Glass and in the consumption of media generated by it (UWIRE, 2014). The work by educators using Glass has already illuminated many of the possibilities and drawbacks of the use of Glass within our schools, allowing for easy utilisation of many of the pedagogical techniques related to the incorporation of technology within education, and the creation many new ideas related to the supporting a variety of learner types (Mishkin, 2015; Nield, 2015).

The possibilities of Glass within education are seemingly endless, as it has the oppurtunity to be the next evolution in ubiquitis computing, whereby the technology itself retreats into the background, where it seamlessly becomes a part of the fabric of our lives, ever present, in contrast to desktop computing which is only accessable in a specific context (Skiba, 2014). In many ways, the general use of Glass by both the teacher and students has the possibility to allow the digital world to enhance education. However due the relatively new technology and the limited supply of these units academic research as to how Glass can be used within education has so far been relatively superficial. This is even further inhibited by problems within Glass's rollout, leading it to be redesigned and re-released at an as yet undisclosed point in the future (Bradley et al., 2014). As such the information I have used to create the following ideas about possible incorporation of Glass into a teaching model, and possible drawbacks, are based on concepts and theories with varying levels of supporting research.

Opportunities of Glass in education

General use of Glass across all subjects

In a theotetical classroom where the teacher and all students are wearing Glass, students will be able to perform ad hoc searches for relevant information to immediately understand any unknown terms or concepts (Skiba, 2014), and can access differentiated videos and information allowing for different avenues to learning (Borthwick et al., 2015). This could also serve a function whereby students who were absent or wish to review material can watch practical recordings made by the teacher during these lessons or even students who were present (Strain, 2013). A teacher's ability to communicate quickly and efficiently with students can also increase, responding to queries of students in the order in which they are electronically submited, also allowing more reserved students to communicate with the teacher in a way that does not make them feel uncomfortable. Teachers can also benefit from Glass via facial recognition programs that can automatically identify students names and even take the roll with very little effort, removing one of the more tedious operations needed currently in every class (Borthwick et al., 2015; Paterson & Glass, 2015).

A number of software programs have been developed by members of the 'Explorer' program for specific subjects to address specific needs of teachers and students, or providing oppurtunities for educational experiences not possible before this technology was developed. One such program was developed to immediately allow musical timing to be analysed and reported to the wearer, allowing a music teacher to give immediate feedback to students in both conducting and instrumental music classes, a much more efficient method than the usual method of videotaping each student and playing this back with feedback at the end of the lesson (Otane, 2013).

A variety of other programs have been developed to assist students with special needs, such as; 'FingerReader, a read aloud programs to assist visual impairments (Marks, 2013), integrated auditory trainers connected to hearing aids to assisst hearing impairments (Borthwick et al., 2015), 'Emotient' a program to recognise emotions to aid students with down syndrome (Paterson & Glass, 2015), and a range of other programs for a variety of conditions.

Private companies or Google itself also create more complex programs for the larger market which can still be used in a educational context. One such program is 'Word Lens', recently bought by Google, which automatically identifies characters, translates these into a specific language, and projects these translated words over a digital copy of the image

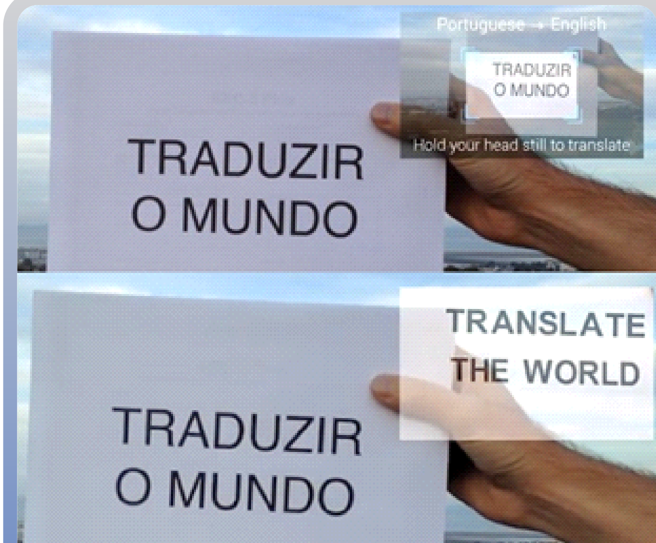

Figure 4: A representation of 'WordLens' being used by Glass, translating Portuguese to English. Screenshots of video retrieved from https://www.youtube.com/watch?v=pZKWW3rzT2Q

(see Figure 4). This is a great tool to allow non-native speakers to comprehend content much more rapidly than identifying unknown words and looking up the translation (Golson, 2013; Marcinek, 2013 in Borthwick et al., 2015). A foreseeable problem that will need to be investigated is how the use of such automatic translator programs could impede language aquistion due to students developing an over-reliance upon them, resulting in the student not actually learning sufficient vocabulary from the target language (Baker, 2006).

Enhanced field trips

Outside of the classroom Glass can also allow for an enhanced field trip experience, an example of this is a freeware program already in use entitled 'Field trip', developed by members of the 'Explorer' program. Within this program the user can look

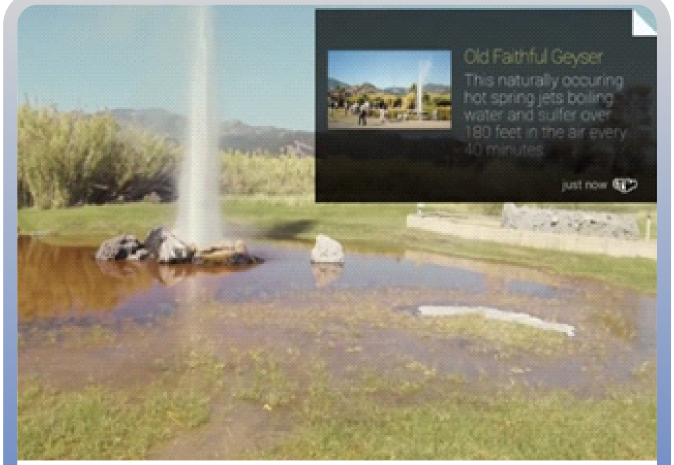

Figure 5: *A representation of 'Field Trip' in operation, retrieving information about a geyser. Retrieved from http://venturebeat.com*

at various structures and have information of that structure retrieved from the internet and displayed on Glass's transparent screen whilst the structure remains in the field of view (see Figure 5). This is made possible by the geolocation data provided by its inbuilt GPS, magnetic and gravity field sensors (which most smart devices have). By using this program, if the data is available, students can learn about any location as they explore them (Borthwick et al., 2015; Paterson & Glass, 2015). I do see a need however to filter such information based upon the purpose of the field trip, as an abundance of information could have a disengaging effect for students, such as we see in museums when people are given the electronic guides.

Additional functions within Glass that could also prove useful during investigative field trips is the video capture function which allows for impromptu short interviews with people met by a student or simply pictures and video/audio recordings of locations with geolocation stamps to give them context. A problem does exist though due to the emergence of negative opinions amongst some members of the public towards users of Glass, which could lead to negative reactions amongst interviewees, impacting on interviews (Paterson & Glass, 2015; Tsukayama, 2014). This negative reaction is explored later within the section 'Negative profiling of Glass users'

Augmented Reality

Augmented reality is an area in which Glass has a great potential to transform in class pedagogy, by it's ability to introduce a interactive digital layer over the physical world, complementing reality, rather than virtual reality, which simply aims to replace it. One of the most utilised methods of augmenting reality is the embedding of videos into physical objects by use of QR codes, specific text or imagery which Glass can scan and play, overlayed onto the same area. This technique allows for 'discovery' of extra information, and if linked via appropriate real-world content, such as related materials (imagery or words), can forge strong mental connections and greater understanding of the content by the students (Borthwick et al., 2015; Gittlen, 2013).

The leading application at this point for such augmented experiences is 'Aurasma', which has been on the market since 2011, designed for all recent smartphones and tablets, with a working version for Glass likely not too far away. This technology already engages students in classrooms by bringing word walls to life, assist in treasure hunts and creating living textbooks and immersive worksheets that link to video's and websites. The limitation at this point is a students needs to hold their smartphone or tablet over their field of vision to experience these augmented experiences (Borthwick et al., 2015). Similar programs on Glass can actually add this extra layer seamlessly over the real world by use of its transparent screen, without the filter of the external device, creating a much more immersive and seemingly 'real' experience (Borthwick et al., 2015; Riterfeld, 2009).

The next step, as is see it exists in the possibility of linking objects in the physical world to the digital world, allowing for a great way to understand more about specific objects and materials. This is already used within clothing where embedded scannable chips connect external devices to online data sources with relevant information (Borthwick et al., 2015). Imagine, for example, holding different types of metal in your hand, with associated short videos appearing, each describing the different ways each metal can be utilised in industry, or manipulated by the students themselves within practicals. This methodology would be far more engaging than simply having students read information or watch a class video at the front of the room. This increased level of reference would further reduce any necessitated mental leap between the material and the information, leading to a reduction in a students necessitated cognitive load, increasing the likelihood that this knowledge will be transferred into long term memory (Cooper, 1998).

Gamification

An oppurtunity also exists with Glass to bring the techniques of gamification to life. Gamification is the concept of extracting the elements inside games, designed to promote the user to keep playing for extended periods whilst learning and operating complex systems, and then applying these concepts to educational methodology (Deterding, Dixon, Khaled, & Nacke, 2011). This generally takes the form of point systems, where students are allocated points when completing educational tasks, with some related bonus scores for fulfilling specific criteria (i.e. all questions correct in first attempt, completion of task within a short timeframe, etc). These points are then accrued and form the basis of the marking system, with possible inclusion of extra game elements, such as leaderboards to promote competition, or levels and rewards which can be reached by continued participation in the program. (Attali & Arielli-Attali, 2015; Deterding et al., 2011). This type of gamified educational method is still in it's infancy, and the limited studies investigating it have produced mixed results, with often little academic benefit compared to traditional educational techniques, although generally there are short term gains in engagement. These studies though, were all conducted in a rather bland computer based format, with varying amounts of access to the activities and feedback, along with limited sample sizes (Lee & Hammer, 2011).

Glass however, via a mix of its augmented reality capability and these gamified elements can begin to make the classroom itself a game, allowing students to access open data sources to compare the other students progress in real time. This could not only further drive competition amongst the students it could also promote communication and collaboration, as students see who has completed specific tasks and can then learn from each other. (Borthwick et al., 2015). Glass can also allow students to exchange information instantly from anywhere they are completing activities, impacting on both the speed and competition of these activities. The competitor network need not be only within the one classroom or even school, allowing for the creation of large game communities where the tasks can be compared and discussed at the students leisure, though care should be taken that such collaboration does not simply mean copying answers (Borthwick et al., 2015; Personas que Aprenden, 2014). There are some dangers that such comparisons amongst students could lead to conflict amongst students as their abilities are likely to differ, leading to a variation in results, as such the educator should take this into account when designing activities and be ready with an appropriate response if such a situation still occurs (Attali & Arielli-Attali, 2015).

Flipped classroom

Perhaps the one instructional method which can be immediately and heavily impacted by use of Glass is the use and effectiveness of flipped classrooms. A flipped classroom involves a student being introduced to a concept via online content which they access outside of class, generally at home, freeing up class time for more engaging, generally collaborative actvities which can reinforce and build upon these previously understood concepts (Hodges & Weber, 2015). This is in contrast to the traditional teaching method where students are both introduced to concepts and engaged in related activities during classtime, with any work outside of class just reinforcing those learnt concepts. Generally the content accessed by students is created either via handheld cameras, fixed cameras on tripods or a screen capture recording of what the educator is viewing on a computer. This technique became popular is relatively recent years, after it gained popularity in the USA in 2006 (Milman, 2012).

Since it's inception flipped classrooms have received much attention from both educators and researchers and has been found to be an efficient method of instruction across a broad range of subjects. The advantage of this method however relies on the following to occur; the quality of the video lecture is of a high standard, all students view and pay attention to the video content, and finally that the concepts can either be sufficiently understood by the students or communication still could ensue between student and educator after or during the viewing to clarify any necessary points. (Carter, Qvarfordt, Cooper, & Makela, 2015; Milman, 2012).

The ability of Glass to revolutionise this process is via the creation of much more engaging media content, created by the educator with Glass in a dynamic and engaging first person format, providing a seemingle 'lived' experience for the viewer (Carter et al., 2015; Paterson & Glass, 2015). Whilst devices such as GoPro can provide a similar recording, Glass has an advantage over these, with possibility for immediate feedback from any users concurrently logged during its live recording and broadcast, less need to consult the device before and after recording, and possible digital overlays of information generated by the many programs which Glass can run (Carter et al., 2015). Although no actual large scale studies have been created to assess specifically how effective Glass is for the flipped classroom, a number of participants in the 'Explorer' program have already begun using Glass in this way, with positive results. One educator stated, in regards to computer science tutorials, that Glass was much more effective than previous screen capture videos in regards to its fluidity, due to its ability to capture the perspective of the computer user with the viewer able to see how the mouse and keyboard were being utilised (Jones, 2014).

In a study of the creation of 'how to' videos by Carter et al. (2015) it was found that veiwers preferred Glass videos in any activity that needed to be completed in a non-tabletop environment, especially with larger objects that required multiple angles. Glass was also preferred by the author, due mainly to its ability to shift their attention from the capture device, allowing them to focus on activity being completed (Carter et al., 2015). An application of such tutorial video's has already been implemented in a online hair stylist series of videos, with students accessing videos created by reputed professionals in the industry who wear Glass whilst they work. This allows students to see the creation of specific hairstyles the professional's point of view, supplemented with commentary, providing a unique, more personal perspective. Whilst interesting, it should be noted that there is no related study into the effectiveness of this specific application. (Introducing Matrix Class For Glass, 2014).

Possible problems with Glass in education

Negative profiling of Glass users

Up to this point, this essay has dealt with the range of possibilities which exist for Glass within education, however there are a number of limitations and even dangers which have to be addressed. One of these is the emergence of a negative stereotype about the users of Glass, primarily in Silicon Valley where there currently is a large amount of Glass users who have begun to wear the system in their everyday life. Within this region there has already been a recent emergence an anti-gentrification movement, resulting from dramatic price rises in property and the rise of a tech-elite culture that is perceived to be out of touch with the rest of society. Many people have begun to feel threatened by the possibility of being filmed by Glass without permission, and have begun collectively derogatorily referring to wearers as 'glassholes' (Paterson & Glass, 2015). Although the majority of the public does not share these sentiments, a handful of attacks on users have already been reported. Ill sentiments about Glass have also begun appearing in restaurant owners, for privacy issues, and movie theatre owners, for piracy concerns, a number of whom have begun banning the use of Glass on their premises. Whilst current laws on driving do not take into account such wearables, police have begun pulling over and fining its users, irrespective of whether the device is active or not, although these were later repealed (Borthwick et al., 2015; Tsukayama, 2014).

All these incidents have been occurring within the limited amount of users of the 'Explorer' program, which itself has a vetting process for its members and frequent communication with them about how to act as 'positive ambassadors' (Tsukayama, 2014). When, however, Glass will be released to the public at large, Google will have no control over its users, and the possibility for conflict and the rise negative stereotype will likely increase. As such we have to understand these safety issues before we, as responsible educators, hand out devices to our students due to such a possibility of harassment and violence.

Internet Addiction Disorder

A physiological danger also exists from a possibility of excessive use of Glass due to a possible connection with Internet Addiction Disorder (IAD). IAD is a relatively new concept and has yet to be recognised by the 'Diagnotic and Statistical Manual of Mental Disorders', the primary reference guide for groups and individuals that have a professional connection to treatment and management of mental disorders. This is likely to change with its next revision as many other prominent publications, such as 'The American Journal of Psychiatry' have recognised IAD as a legitimate clinical disorder, similar to other addiction disorders, with an ever growing amount of people being diagnosed with the condition and recognition of symptoms including isolation, sleep deprivation, mood swings, withdrawal and even seizures (Bishop, 2015; Shea, 2015; Yung, Eickhoff, Davis, Klam, & Doan, 2015).

IAD has been especially prevalent in China and South Korea where it is seemingly quite common for large amounts of the population to spend excessive amounts of time connected to the internet. South Korean governmental reports estimate that around 2 million school age children either suffer from this disorder or are at risk and within China there are reports that state that at least 10 million adolescents suffer from IAD (Bax, 2013; Shea 2015). For the South Korean example, the government is already running centres that attempt to deal with IAD en masse via a variety of techniques, ranging from counselling to a highly questionable use of 'magnetic shock therapy' (Shea, 2015).

As such any possibility of such a disorder being promoted by use of Glass should be thoroughly investigated, and unfortunately there has already been one documented case of IAD from excessive use of Glass by a participant of the 'Explorer' program. This patient would often spend 18 hours a day using Glass, both at work, as it allowed him to function more effectively, and at home, removing for only sleep and bathing. Symptoms of frustration, irritability and argumentativeness began to be noticed of the patient after extensive periods of use, and, upon seeking treatment, he reported problems with short term memory and clarity of thought, even having his dreams as if looking through Glass. After a 35 day treatment consisting of therapy and non-use of Glass, all symptoms except for the dreams recorded significant reductions in occurrence. It should be noted that this patient did have a history of drug abuse, as such was already predisposed to addictive tendencies (LaPlante, Nelson, & Shaffer, 2012; Yung et al, 2015).

Due to both the seeming predisposition of youth within today's culture to acquire IAD and with a case already occurring within a relatively small sample of people and timeframe, any attempt to incorporate Glass to a large extent within the education system should be taken with care (Bishop, 2015; Yung et al., 2015). We should remind ourselves however that this is just a single case, and as such further research should be undertaken about this possible connection to IAD, especially in regards to adolescents.

Privacy of students and teachers

Possibly the largest barrier to Glass's acceptance within education is the concern relating to the production of large amounts of media by and of students, and the possibility of the privacy rights of these students being violated when this data is handled improperly. This issue links onto a larger perceived problem facing society of 'big data', whereby massive quantities of media are being created by members of the public, with vague legalities upon who, if anyone, owns this data (Kelly, 2013; Paterson & Glass, 2015). As such, within a school context where the data relates to underage students, if such data became available to members of the public, large legal and moral implications will inevitably occur. Seemingly the only option available to address this is secure onsite storage, rather than storage provided by external private organisations, with an implicit understanding of teachers that this data is to be deleted once it is no longer needed (Brickman & Geolitz 2014 in Borthwick et al., 2015). This process however is not fool proof students can store their information wherever they choose as long as they have internet access, which will likely occur even if instructions advising against this are communicated.

Generally the teachers who themselves are interested in using Glass in their classes see this technology as an opportunity to approach teaching from a different direction and allow learning processes to become easier and more fluid. Within the faculty at large however there are many teachers that are concerned by the implications of Glass and the implications it brings for them and are often acting to stifle attempts by other educators to introduce Glass and other wearable technologies into schools. (Borthwick et al., 2015; Vaughan, 2013). These educators often fear that mandated or allowed usage of such technology, with students ability to record and immediately broadcast teachers' actions to the world and could result in their actions whilst teaching misconstrued (Skiba, 2014; Strain, 2013).

Technical problems

Due in most part to Glass being only available in the beta stage, a number of hardware problems and software difficulties have surfaced, along with a variety of suggested improvements to the device which could improve overall functionality.

A common problem noted by users is the tendency for the arms of Glass, which is where the battery is stored, to become overheated and uncomfortable for its users, even powering down when it reaches a critical temperature (Jones, 2014). This is a result of the devices small size and weight of 36 grams, which also limits battery life to around 5 hours, with a need to charge up daily (Bregger 2013; Paterson & Glass, 2015). There is no obvious solution for this problem, other than creating a larger, heavier device, which is not what the general public would not want. Larger alternatives to Glass with better functionality are available but are predictably proving less popular with the market (Bregger, 2013). One problem, distinct from the others listed here, is that most users simply find Glass to be ugly, which, over all other problems, is the main drive behind the current re-design of the product (Marks, 2013; Paterson & Glass, 2015).

In terms of software, there is a range of small problems, including no preview for photos, special selection needed for video clips longer than ten seconds and no option to auto-upload content (Carter et al., 2015). The most troublesome software issue, especially in a multi-user school environment, is the limitation of only one Google account logged into each unit, with a factory reset necessitated if a alternate user wishes to login to the device (Paterson & Glass, 2015). As these issues are not linked to the hardware of the device it is likely that subsequent updates to the core software could fix these problems, which will likely occur in the near future, or simply be included in the updated product (Marks, 2013).

Whilst some problems with the current features have emerged there are also a range of suggested improvements to Glass, especially towards the goal of ubiquitous computing. Currently Glass picks up on verbal commands, specific images, motion, orientation, proximity and eye winks, however there is also opportunity for it to respond further to wearers gestures such finger clicks and hand waves. Another idea is to utilise face capture technology, already existing in other products, which allows an image of the user to be created by stitching together videos from multiple cameras recording different sections of the face, which can then be included in chat or video recordings (Carter et al., 2015; Marks, 2013). A further idea is the inclusion of gaze tracking technology, where a sensor analyses the user's eye movements to identify what the user is looking at. The applications of this could range from simple warnings if the user is looking at too much 'junk', all the way to creating an ever more immersive experience where a menu can be activated simply by looking at it (Marks, 2013).

Looking ahead

Whilst the Glass programme is undergoing its current overhaul, any widespread use of this technology in the classroom will have to wait. Microsoft is also preparing to release its product to rival Glass, the HoloLens, although with much less hype and attention than Glass has received. The incorporation of Glass within education, if it happens at all, is likely to be an incremental one, as has already been occurring on a small scale with the few units already in circulation. Initially some teachers will likely begin attempting Glass for the uses I have described in this essay, as well as for other novel uses. In doing so many will likely come across a variety of problems, possibly including those I have described here, and it is in how they overcome these obstacles, or in turn are overcome by the obstacles, that will likely determine the future of Glass within education. However if these 'pioneers' of Glass do manage positive results, I look forward to the future of classroom where both students and teachers can take full advantage of Glass and other wearables, and, in line with the ubiquitous computing ideology, allow technology to support learning in an open and reflexive manner, rather than impede it by creating a unnecessary technological barrier.

Top tips for educators

If an educator is interested in the possibilities of Glass for their classroom I recommend these 3 top tips;

1. Start Small

Rather than going all in and buying a unit for evey student in the class I would recommend firstly the educator themselves begins experimenting with how they can use a single unit to create and utilise material, both in and out of class, as in the flipped classroom example. This also limits legal complications as the students do not have the opportunity to misuse the technology, and give the educator an understanding of how to best handle this difficulty if the decision is made to incorporate student use.

2. Become part of the community

Being the first educator within an institution to attempt using Glass can seem isolating and overwhelming, especially given how complicated many of these BETA applications can be, however you are not alone! Many others have been experimenting and sharing their insights online, and they are eager to build their community. Joinng the Google+ community through groups such as 'Google Glass in Education' can make this process less daunting , access the following link to have a look; https://plus.google.com/communities/107609996462187425150

3. Lead by example, don't be shy!

It's difficult to change the whole culture of an educational institution all at once, however if effective use of this technology is achieved, an educator should be proud of their achievement and discuss, and even incorporate, other faculty members in the use of Glass in the classroom. Cultural shifts within school take time; however, as we have seen with other technology, educators are adaptable to such shifts in practice if they can see such positive uses in action.

References

Attali, Y., & Arieli-Attali, M. (2015) Gamification in assessment: Do points affect test performance? *Computers & Education*, *83*, 57-63. doi: 10.1016/j.compedu.2014.12.012

Baker, C. (2006). *Foundations of bilingual education and bilingualism*. Chicago, IL: Clevedon.

Bax, T. (2013). Youth and Internet Addiction in China. Hoboken : Taylor and Francis. Retrieved from http://www.eblib.com

Bishop, J (2015) Psychological and Social Implications Surrounding Internet and Gaming Addiction. *Centre for Research into Online Communities and E-Learning Systems.* Retrieved from http://www.igi-global.com.ezproxy.lib.monash.edu.au/gateway/book/125524

Borthwick, A., Anderson, C., Finsness, E., & Foulger, T. (2015). Special Article Personal Wearable Technologies in Education: Value or Villain? *Journal of Digital Learning in Teacher Education, 31*(3), 85-92. doi:10.1080/21532974.2015.1021982

Bradley, D., Russell, D., Ferguson, I., Isaacs, J., MacLeod, A., & White, R. (2014). The Internet of Things– The future or the end of mechatronics. *Mechatronics 27*, 57–74. doi:10.1016/j.mechatronics.2015.02.005

Bregger, E. (2013, August 28). UA professor, graduate students work on hands-free technology similar to Google Glass. *UWIRE Text*. Retrieved from http://go.galegroup.com.ezproxy.lib.monash.edu.au/ps/i.do?id=GALE%7CA341169076&v=2.1&u=monash&it=r&p=AONE&sw=w&asid=ca6449f6cc7e92ee04c97ef7dd0a100a

Carter, S., Qvarfordt, P., Cooper, M., & Makela, V. (2015). Creating Tutorials with Web-Based Authoring and Heads-Up Capture. *Pervasive Computing, IEEE, 14*(3), 44-52. doi:10.1109/MPRV.2015.59

Cooper, G. (1998). Research into Cognitive Load Theory and Instructional Design at UNSW. University of New South Wales. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.470.3428&rep=rep1&type=pdf

Deterding, S., Dixon, D., Khaled, R. & Nacke, L. (2011) From game design elements to gamefulness: defining gamification, *Proceedings of The 15th International Academic Mindtrek Conference,* Tampere, Finland. Retrieved from https://scholar.google.com.au/citations?user=BvHFgSwAAAAJ&hl=en

Gittlen, S. (2013). Will Google Glass Usher Augmented Reality into the Classroom? *EdTech.* Retrieved from http://www.edtechmagazine.com/k12/article/2013/10/will-google-Glass-usher-augmented-reality-classroom

Golson, J. (2013, May 20) Google picks up incredible visual translation app Word Lens and makes it free. *TechRepublic.* Retrieved from http://www.techrepublic.com/article/google-picks-up-incredible-visual-translation-app-word-lens-and-makes-it-free/

UWIRE. (2014, November 21). Google Glass Users Discuss Research, Projects Comments. *UWIRE text.* Retrieved from http://go.galegroup.com.ezproxy.lib.monash.edu.au/ps/i.do?id=GALE%7CA391009879&v=2.1&u=monash&it=r&p=AONE&sw=w&asid=0d787da7d2ac7f7480f5481e0ebe8de9

Grinberg, E. (2014, February 10). When will Google Glass go to class? *CNN Wire*. Retrieved from http://go.galegroup.com.ezproxy.lib.monash.edu.au/ps/i.do?id=GALE%7CA358225014&v=2.1&u=monash&it=r&p=AONE&sw=w&asid=f8b6ebafa8928b38b65b7b5156416e17

Introducing Matrix Class For Glass. (2014, January 17). *PR Newswire*. Retrieved from http://go.galegroup.com.ezproxy.lib.monash.edu.au/ps/i.do?id=GALE%7CA355859610&v=2.1&u=monash&it=r&p=AONE&sw=w&asid=6b3ce246e15fdcbeafcbde146cec8b4e

Jones, J. (2014, February 20). GRCC joins Google Glass Explorer program. *UWIRE Text*. Retrieved from http://go.galegroup.com.ezproxy.lib.monash.edu.au/ps/i.do?id=GALE%7CA359185742&v=2.1&u=monash&it=r&p=AONE&sw=w&asid=c34b57f88d42f289514829OObdc92e63

Kelly, H. (2013, December 10). Google Glass users fight privacy fears. *CNN Wire*. Retrieved from http://go.galegroup.com.ezproxy.lib.monash.edu.au/ps/i.do?id=GALE%7CA352350828&v=2.1&u=monash&it=r&p=AONE&sw=w&asid=1e33a5c3ad144aee0864469e9270874e

Knoxlabs. (2015). *Knox V2 - Google I/O 2015*. Retrieved 11 October 2015, from http://www.knoxlabs.com/products/knox-v2

Marks, P. (2013). A healthy dose of Google Glass. *New Scientist, 219*(2936), 22-23. Retreived from http://www.sciencedirect.com/science/article/pii/S0262407913623295

Mishkin, S. (2015, May 11). Wearable technology finds its place on campus. *Financial Times*. Retrieved from http://search.proquest.com/docview/1687235314?accountid=12528

Nield, D. (2015, July 28). Wearable technology in the classroom: what's available and what does it do? *The Guardian*. Retrieved from http://go.galegroup.com.ezproxy.lib.monash.edu.au/ps/i.do?id=GALE%7CA423474061&v=2.1&u=monash&it=r&p=AONE&sw=w&asid=2f04a85f771d3f8372323c59f54dc55a

Otane, A. (2013, October 24). Cornell Music Professor Becomes 'Google Glass Explorer'. *UWIRE Text*. Retrieved from http://go.galegroup.com.ezproxy.lib.monash.edu.au/ps/i.do?id=GALE%7CA346652658&v=2.1&u=monash&it=r&p=AONE&sw=w&asid=13fd548442da33a9af26f3d8bceedaed

Paterson, M., & Glass, M. (2015). The world through Glass: developing novel methods with wearable computing for urban videographic research. *Journal of Geography in Higher Education, 39*(2), 275-287. doi:10.1080/03098265.2015.1010143

Personas que Aprenden (2014, June). Wearables in education: Devices and analysis. America Learning & Media. Retrieved from http://www.americalearningmedia.net/edicion-004/267-innovation/3661-wearables-in-education

Lee, J. J., & Hammer, J. (2011). Gamification in education: What, how and why bother? *Academic Exchange Quarterly, 15*(2), 1-5. Retrieved from https://www.uwstout.edu/soe/profdev/.../Lee-Hammer-AEQ-2011.pdf

Milman, N. B. (2012). The flipped classroom strategy: what is it and how can it best be used? *Distance Learning*, *9*(3), 85-86. Retrieved from http://go.galegroup.com.ezproxy.lib.monash.edu.au/ps/i.do?id=GALE%7CA305660562&v=2.1&u=monash&it=r&p=AONE&sw=w&asid=83eb2cb972cfc092f59ad15b94e4f337

Ritterfeld, U., Cody, M. J., & Vorderer, P. (2009). *Serious games: mechanisms and effects*. New York: Routledge.

LaPlante, D. A., Nelson, S. E., & Shaffer, H. (2012). *APA addiction syndrome handbook*. Washington, D.C: American Psychological Association.

Shea, M. (2015, March 17). The Celebrity Millionaires of Competitive Gaming [Video]. Retrieved from http://www.vice.com/video/esports-part-two

Skiba, D. J. (2014). The connected age and wearable technology. *Nursing Education Perspectives, 35*(5), 346-347. Retrieved from http://search.proquest.com/docview/1561005652?accountid=12528

Strain, R. (2013). Google Glass. *Conference & Common Room, 50*, 36-37. Retrieved from http://search.proquest.com/docview/1444950944?accountid=12528

Tsukayama, H. (2014, February 26). Anti-Glass attack in San Francisco highlights tension over wearables. *Washington Post*. Retrieved from http://go.galegroup.com.ezproxy.lib.monash.edu.au/ps/i.do?id=GALE%7CA359892188&v=2.1&u=monash&it=r&p=AONE&sw=w&asid=7fdc8aed570f0a119f916af29a6d4ab8

Vaughan, R. (2013). Bringing new meaning to the spectacle of learning. *The Times Educational Supplement*. Retrieved from http://search.proquest.com/docview/1400981576?accountid=12528

Yung, K., Eickhoff, E., Davis, D. L., Klam, W. P., & Doan, A. P. (2015). Internet addiction disorder and problematic use of Google Glass™ in patient treated at a residential substance abuse treatment program. *Addictive behaviors, 41*, 58-60. doi:10.1016/j.addbeh.2014.09.024