



Pupils in the clouds: Implementation of Google Apps for Education

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Abstract

The study focuses on the implications of affordances identified in Google Apps for Education (GAFE), by strategic staff within a Swedish school organisation, with responsibility for schools in around 30 municipalities. A complex picture emerged, where GAFE was perceived both as a neutral, well-functioning tool and as a means of educating in partly new ways. Furthermore, the study shows that GAFE, despite its characteristic of being a non-generative appliance, still can be used in creative ways. The implementation of cloud technology, such as GAFE, endorses a tunnel-vision affordance that downgrades more nuanced perceptions of the different technological, economical, and ethical aspects of the technology. Studying GAFE, different tensions of power emerge: Google vs. the school, IT professionals vs. teachers, management vs. teachers, teachers vs. pupils, Google vs. pupils.

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1. Introduction

Wild technology tends to be domesticated relatively quickly, and tamed into everyday objects (Haddon, 2006). Domestication leads to technology being taken for granted. Indeed, information technology (IT) usually evolves into unexciting artefacts for routine everyday usage. In modern society, IT has become crucial at home, at work and in schools. Through the introduction of cloud computing the taken for grantedness of, and dependence on, IT seems even greater than ever before. Google Apps for Education (GAFE) is currently being introduced in Swedish schools (the national context of this study) and is successively becoming an accepted generic information technology — a tamed everyday object. This paper investigates how one particular school organisation implements this standard cloud software in their educational settings.

Building on constructivist studies of technology and organisation, this article is concerned with GAFE as a generic bundle of IT tools in schools. Constructivist studies tend to draw complex, messy sketches of how technology is developed, negotiated and used within different settings. Technology is seen as co-constructed, rather than following a predestined trajectory. Technologies are not viewed as independent phenomena; rather, they are embedded in their social contexts (Williams and Edge, 1996).

Furthermore, this paper is concerned with the issue of power, which has also been addressed within constructivist studies. Four clusters of power studies are possible to detect: 1) political power, 2) corporate power — often with a Marxist perspective, 3) code is law — *i.e.*, power as encoded in the artefacts — and 4) power/knowledge — *i.e.*, power encoded in organisational structures — in line with ideas developed by Foucault (1980). Recently we have seen an increasing number of studies on IT implementation and use within organisations, but this study addresses understandings of why the technology is implemented and how it is used — *i.e.*, the question of power within cluster 4 — which has been investigated more seldom (Leonardi and Barley, 2010).

In this article, schools are viewed as organisations implementing new forms of IT. As such, the study is connected to other investigations of organisations implementing new IT (*e.g.*, Brady, *et al.*, 1992; Clark, *et al.*, 1988; Clark and Staunton, 1989; Fleck, *et al.*, 1990; Leonardi and Barley, 2010; McLaughlin, *et al.*, 1999; McLoughlin, 1999; Orlikowski, 2010, 1992; Orlikowski and Barley, 2001; Webster and Williams, 1993; Zuboff, 1988). In recent years, the implementation of IT in education has been investigated using the theory of affordance (*e.g.*, Bower, 2008; Kreijns, *et al.*, 2002), which is also applied in this study. Studies of perceptions of cloud computing in education are rare, especially studies that concern other levels than higher education. One exception is Lim, *et al.* (2015), who investigate Swedish principals' perceptions of cloud computing.

GAFE is a prominent example of the broad array of IT grouped under the umbrella concept of cloud computing. Cloud computing is characterized by Internet-based delivery of software, platform and infrastructure services. Although the introduction of cloud computing into organisations entails dramatic consequences, not only for individual and collective practices, but possibly also for the structure of the organisation itself, there have so far been few constructivist studies conducted in this area. This is disconcerting as even consultants connected to the cloud computing industry often frankly state, in the IT press, that this technology will dramatically change how information and IT is perceived, managed and used in organisations. For instance, a central claim is that users can facilitate their own needs for IT software and storage, without the involvement of IT experts, as IT has become a utility (Carr, 2008). Literature within the IT press (*e.g.*, Stuart and Bromage, 2010) stresses the different affordances of cloud computing. Some authors underline economic advantages as an important driving force, claiming IT costs will decrease. More moderate experts commonly argue that security and privacy issues are at stake. They also fear decisions to implement cloud computing will solely be based on the technical standpoints of IT departments, without any involvement from business functions and others using cloud computing in their daily work.

Given the recent development of adopting GAFE in schools, studies are urgently required to complement previous research. Even though GAFE has been in the makings for close to a decade, it has so far not been targeted for study through a constructivist approach. Earlier research has tended to focus on the educational and/or technological benefits to be gained, often with an awestruck tone, as suggested by the title of an early article (Barlow and Lane, 2007): "Like technology from an advanced alien culture". Based on the above, our aim is to show the complexity of implementing a technology such as GAFE. Our focus is on educational organisations and information management, but some results are valid for many other types of organisations. The research question in focus is:

What functional and usable affordances of Google Apps for Education are perceived by members of educational organisations, and what implications for schools can be recognized?

The current study is based on semi-structured interviews with strategic, both technical and non-technical, staff members of a Swedish school organisation, in around 30 municipalities. The interview approach has its limitations, as it is difficult to take a full inventory of affordances without studying the everyday practices of a number of different people in the organisation. However, a point of departure is that what a person says gives insights into how the affordances of technology are perceived.

The interviewed staff members had different strategic positions within management, education and IT.

We use the concept of affordance as originally articulated by Gibson (1979), although as elaborated by Raudaskoski (2009). In this study, affordances are understood as the perceived properties of GAFE that support different actions. The site of the affordance is thus not GAFE in itself, but its relationship to its users in their specific environment. Raudaskoski (2009) has studied the affordances of the mobile phone, suggesting two basic concepts — functionality and usability. The former indicates that individuals learn the basic functions of a technology. The latter indicates that individuals learn to adapt the functions to their own purposes. Usability concerns user recognition of affordances and "constitute the basis for real applicability" [1]. If the user does not perceive ways of adapting the device to her own purposes, focus will instead be on its functionality on its own premises. [2] This article is concerned with how staff within a school perceives GAFE's affordances in relation to the two concepts functionality and usability.

2. Cloud computing as non-generative appliances

Zittrain (2008) has discussed both the PC and the Internet in terms of generative technology, *i.e.*, by developing "unfinished" platforms, with very few restrictions regarding usage, developers are free to create a multitude of software well beyond the original intentions of those designing the platform. In contrast to open-ended platforms such as the PC and the Internet, which signal few limits regarding affordances, proprietary appliances are fixed both in functionality and ownership, disallowing other actors opportunities to build in other features. Zittrain discusses corporate owned appliances in general as "non-generative technology." Moreover, cloud-based appliances are tethered appliances and he argues that there is a substantial shift involved when our software is moved from the local hard drive to ubiquitous cloud-based software. Zittrain perceives these non-generative appliances as

threats to the open-ended creativity stimulated by the free Internet and PC. Proprietary appliances are instead associated with more control and regulatory surveillance.

GAFE, which is the cloud-based appliance in focus, contains a multitude of software that addresses various needs of teachers and pupils:

- Google Classroom (not in use by the school studied at the time of data collection)
- Gmail
- Google Drive
- Google Calendar
- Google Docs
- Google Sheets
- Google Presentation
- Google Sites (only in use at a couple of schools at the time of the interviews) (Google for Education, 2015)

These can be seen as the typical, tethered appliances of our time, allowing educational processes to be mediated by cloud. The move from data on personal hard disks to cloud-based tethered appliances is Google's overall strategy — to combine user "lock-in" with an image of presenting themselves as neutral conduits for data traffic (Dijck, 2013). Given that most educational needs are perceived to be satisfied within this suite of applications users are led to lock-in.

In the schools investigated, "Google Sites" was not available at most of the schools due to issues of interoperability with other technology already in use. The remaining applications functioned as generic educational technology. The "Google lock-in" was further reinforced as pupils were given a Google Chromebook on starting school.



3. Method

In selecting a suitable case for the study we thought to investigate an organisation with substantial experiences of cloud computing. The chosen organisation has used educational technology for several years and consists of around 30 school units. The school is funded by the Swedish public school system, which educates pupils between the age of 10 and 19.

Our purpose was to discuss strategic issues as well as perceived affordances with key staff, drawing on extensive experiences of IT in the organisation both over time as well as in different school settings. The number of interview participants was limited due to the few roles of strategic staff involved in the implementation. As in many qualitative studies, it is not through the number of participants the adequacy of the informants' perceptions is judged (compare Flyvbjerg, 2006).

The empirical material consists of six semi-structured interviews, carried out in mid-2014. The interviews were conducted face-to-face, in places chosen by the informants. The length of interviews varied between 80–120 minutes. The interviews were taped and transcribed by the interviewer. Quotes have been translated from Swedish into English.

Respondents were selected on the basis of an ambition to include the full range of perspectives guiding the implementation process of GAFE, since it was assumed perceptions of affordances would vary considerably between professional roles. The professional roles of the informants were: IT teacher (11), IT director (12), Chief Information Officer (CIO) (13), director of education and development (14), Content Management System Manager (CMS manager) (15), former Chief Executive Officer (CEO) (16).

The interview guide was themed as follows:

- The individual's role in the organisation
- The implementation process
- Different opinions and expectations
- How the technology was appropriated by the organisation
- Perceived pros and cons of the technology

The analysis of the interviews was conducted iteratively in a qualitative content analysis process, inspired by Lundman and Hällgren Graneheim (2008) and Schreier (2012). This method involves the systematic description and structuring of the interview material in an iterative process. The research question guided the overall process and the identification of meaningful parts of the interviews.

In the analysis of the perceived affordances of GAFE, the starting point was taken in the two concepts related to affordances — functionality and usability (Raudaskoski, 2009) — which, in turn, constituted the code. Interview sections, in which an affordance was identified, were segmented in units of coding, which were then paraphrased. The subcategories were derived from the units of coding, to formulate the perceived affordances. The next step was to identify categories that represented the range of uses, in which the affordances were identified, see [Table 1](#). In an iterative process three categories — education, information management and technology — could be distinguished. In the following we will

first discuss the contexts surrounding implementation of GAFE as perceived by respondents. This will lead into a section on perceived affordances.

Table 1: One example of the affordance analysis. Note: Units of coding are combined step by step into categories and subcategories.				
Unit of coding	Paraphrase	Code	Subcategory (Affordance)	Category
I1: When teachers started to use GAFE, they still had to figure out, more or less on their own, how to use it in their teaching. So, that's simply why they use GAFE differently in schools. They have reached different levels, too. We are diverse — we are a compulsory school and a high school. We are four to six and seven to nine. It is obvious that we use it in different ways	Teachers, as well as schools, have reached different levels of GAFE use, explained by differences between school levels.	Functionality	Use of GAFE differs	Education



4. Considerations before implementation

Tensions can be identified between somewhat overlapping “implementation concerns” in the empirical material — economic, technological, security, and privacy/legal. These concerns are also interesting to examine from the perspective of technological lock-in, *i.e.*, once a decision is made technologies become domesticated, permanent fixtures of the organisation, a process that is difficult to reverse. None of these aspects relate directly to the actual perceived affordance of the technology itself (discussed in [The affordances of GAFE](#), below).

The decision to implement GAFE in the organisation has bearing on economic considerations. The CIO stressed that educational development was the uppermost issue for the school's survival and could not be constrained by IT initiatives, rather an alignment was considered:

Technology must cost, but [...] cannot steer the constraints we have to apply in other places. [...] if we don't put money into educational development, then the school will not evolve. Then the way we work will not develop. Our methods will not develop. I wanted to move money to that. I've always worked closely with our pedagogical

development unit [...] to find new ways, new forms of work and new tools. (13)

GAFE was perceived as an ideal IT solution in terms of budget, as schools, contrary to many other types of ventures, can use the cloud service free of charge: "When we talk to consulting firms, they think schools are so early with cloud-based solutions and the brief explanation is that it's free, or whatever you say, which means it's very attractive, while businesses have to pay" (12). Due to the absence of any economic costs — but rather substantial savings on IT — the suggestion of implementing GAFE met little resistance. The (former) CEO reasoned about the advantages of cloud computing:

Suppose IT costs had risen by one million per year, and we proposed the costs [for IT] would not increase. Party, huh. No problem! It's absolutely right! Or assume [the costs] had increased by half a million every year and we came up with a suggestion that instantaneously would lower costs by one million. Yes, but then what? The next item on the agenda! These are decisions that make themselves. (16)

Worries about the unknown future costs of GAFE were expressed; if, in the long run, it would be as cost-effective, that it might not be free in a few years' time. Management were instead concerned that cloud computing could reduce or eliminate some areas for decision-making, such as deciding storage volumes, and whether to purchase servers. These are technological and economic considerations. Notably, pedagogical visions or strategies are absent in this argument. Notions of teaching and learning do not figure as substantial parameters.

No one questioned the implementation of GAFE in the executive committee or management, despite legal uncertainties, since there were technical issues to be solved, caused by the dysfunctional solution currently in use: "We did not take it much further than that we noted this is not legally tight. We summarized by saying, 'the legal situation is unclear' in the management and the board. No one was questioning much, because there were problems to solve." (13) The CIO was worried about security issues and uncontrollable use, as well as the risk of violating current legislation, for example the use of sensitive information about pupils in GAFE. He stressed that resources in schools are scant in general for managing IT security issues. Still, his view was that GAFE was secure enough for the type of information the system was planned for. This can be seen in the perspective of GAFE obviously involving substantial economic savings.

The economic argument is seductive for schools that work under severe budgetary constraints, as costs for educational technology have been steadily increasing. This means there is little room for reflection on the move from utilizing PCs as an open-ended generative technology to the tethered proprietary appliances supplied by Google. This also entails a technological lock-in to a range of applications that may not be optimal, but are well connected and where migration between them is facilitated. The decision in effect aligns Swedish school practices with Google — one of the most powerful multinational corporations of our time.



5. Implementation of GAFE

The initiative to implement GAFE was taken by the IT staff. Important to emphasize is that Google provides a free for use powerful package of educational applications that, so far, has no substantial competition. Teachers were involved, but did not take the lead in this process. Initiatives were taken by IT staff to include the educational perspective: a pilot was set up including teachers and pupils; a GAFE group was created, including both technical and educational competence. Once the decision was made, the IT staff contracted a consultant to facilitate the implementation. This involved the development of communication strategies and training in "GAFE education." Initially training was aimed at early adopters, "superusers," later on, all educational staff were included.

The respondents' overall perception was that GAFE had been well received in the organisation. Running through all the interviews is the viewpoint that the implementation worked surprisingly well and its advantages outweighed its disadvantages. The staff had a shared understanding, that contemporary schoolwork was tied into information technology, and that the earlier IT environment had to be upgraded. GAFE seemed to satisfy the socio-technical needs.

Curiously, then, as the technology was beyond criticism, remaining problems were seen to reside within the organisation: "So it's quite nice [using GAFE] since we can't blame the technology for not being able to do certain things. Instead, teachers don't have time to upload it and then it becomes more of an organisational issue." (12) Teachers' inability to learn and develop their use of GAFE was a theme that appeared frequently. The significance of the time condition is evident in a statement by the head of educational development, who presents a metaphor for seamless technology in education:

Probably it is as with clothes; you don't want to feel they chafe. They should just work. And that's a little bit the same here. You shouldn't have to worry about [technology]. It should just work. For then you

have time to think. (I4)

Here, technology is best when you do not notice it — unobtrusiveness is stressed.

According to the respondents, teachers varied widely regarding IT competence, interest in GAFE and the time they felt they could devote to training. Variations in the ways teachers could use these applications became a problem, leading to differences between individual pupils' competence and use:

Here we see there is quite a wide spread of competence, interest and time to put into it. Some teachers do it at once [but not all] and there, of course, the difference between pupils becomes too large. (I4)

Time and effort devoted to learning the new technology also differed between schools in the organisation:

You can see the differences between different schools by how well they use Google Apps features. A principal who is positive may say "you get two hours on Friday to show us the calendar function," while another principal might not do that. (I3)

Teachers have not initiated this use of IT in education (Player-Koro, 2013). A statement by the CIO can partially explain the differences in competence and interest in general:

The educational system has during many, many years now pushed technology [into the schools] — everything from one-to-one-initiatives to smart boards and anything possible, not used. [...] A clever salesman can show how great it is and then you put it into the hands of a teacher who doesn't have time to learn the stuff, who does not quite understand "What do I use it for? What does it add to my sphere of life?" (I3)

The teachers did not ask for GAFE but it did impact on their interaction with pupils, as well as other staff. Furthermore, activities were standardized, allowing all involved stakeholders the use of the same applications. Clearly, then, implementation of a standardized technology necessitates disciplining users, both teachers and pupils, into the same best practices. Staff not utilizing the technology recognized as best practice could possibly become a problem. Similarly, highly knowledgeable teachers could no longer introduce alternative applications to pupils, even if they outperformed GAFE.



6. The affordances of GAFE

The identified affordances were divided into three categories during the iterative process of analysis: technology, education and information management.

Concerning *technology* and referring to functionality (Raudaskoski, 2009), the following affordances were identified by the respondents:

- ubiquitous access: independent of time and space
- robustness: reliable and trustworthy service
- scalability: possibility to use the same IT-solution regardless of situation
- connectivity: access to cloud through different devices
- aggregated: "intuitive" well-integrated functions

Overall, GAFE was perceived to be pliant, offering many different functions, thereby satisfying varying needs. Furthermore, a statement made by the IT manager refers to usability:

When someone comes along with a request, you have said "no, it is difficult, it is not possible for [our IT solution] does not support it". There were technical limitations. But with this smorgasbord with loads of different features I've been able to point out: "you'll find it here," "use the calendar like this". So it's quite nice since we can't blame the technology for not being able to do certain things. (I2)

This new possibility of showing staff how to use the tools for their own purposes in turn increases IT's credibility in the organisation. The combination of GAFE and Chromebooks was seen as an advantage, improving the IT experience. Still, some teachers found Microsoft Word superior to Google Drive, since certain features are missing in the latter, which created workarounds. However, GAFE was perceived "good enough". The problem of lock-in effects was not seen as overly problematic, rather as something unavoidable in all IT services. The switch to "permanent beta", with Google continually changing the interface, was noted and seen as an element introducing a level of unpredictability, *i.e.*, causing users at times to make minor adjustments in perception and practice. Furthermore, teachers who still wanted to use Microsoft Word at home had difficulties syncing their local drives to store a document properly in Google Drive.

In *education*, the overall perceived affordances of GAFE had varying characteristics, and it was seen as both functionality and usability. With bearing on functionality, GAFE was perceived to afford:

- good enough functionality: basic tools for school work and communication,
- uniformity: everybody works with the same applications and formats
- simplicity: low threshold for creating and working in GAFE
- information sharing: both between pupils/teachers and pupils/pupils
- co-production: several people could work on the same document without restrictions in time and place

The perceived usability affordances of GAFE were developments in educational methods and positive effects on learning. References to the development of methods for teaching and learning can be found in the respondents' utterances:

- collaboration: changes in pupils' collaboration, which raised the quality of school work
- discussion: facilitating in-depth discussions
- reflection: facilitating new insights
- feedback: teachers' possibilities to comment in pupils' documents
- sharing: new forms of dissemination of information

Implementation was perceived to quicken the development of new educational solutions. The head of educational development was surprised how quickly some teachers transformed some processes, such as pupils' own assessments and discussions on how they could get to higher levels:

The teacher will understand not only what [the pupils] responded with, but also how they have envisioned the task. He can help them by understanding "they are going to go forward like this. Well, then maybe I need to change my training so I can meet their needs, or wait, there are four ways to solve this". There will be another discussion. This might have happened without [the technology], but I don't think it had started now. [It's a surprise] they didn't get stuck in technical issues. It went so smoothly that they took it to another level so quickly — a pleasant surprise. We were so suspended in "Will it work today?" "Do I need to print this?" We were so down to the "nitty gritty" stage. (14)

The head of educational development described how work processes had changed due to GAFE. Along with the increased visibility of both individual and group learning processes, some teachers had inferred tests were no longer necessary:

The work process, with regard to assessments of pupils' work, has definitely changed, not 100% in all places, but largely, from the time when the pupil printed out his or her text, submitted it and the teacher sat with a pile to grade afterwards. Now, you can actually provide feedback along the way. Last year we had schools that introduced the project "How can we get rid of tests?" (14)

The technology thus can be seen to support a different view of knowledge and knowledge development, and respondents asserted that GAFE rendered pupils' learning processes more visible. The Swedish school system is regulated by a curriculum. In 2011 a new curriculum (*LGR 11*, 2011) was approved with new requirements concerning the assessment of pupils' "abilities" or "visible learning" as a complement to the conventional assessment of "central content" which indicates a shift in educational objectives. GAFE seems to support these goals by making the learning process visible. Although the interviews conveyed several impressions on the emergence of this changed view of knowledge, it is, nevertheless, important to emphasize that this was a shift in pedagogical style made possible by the affordances of the technology and not only driven by new pedagogical ideas.

As we understand it, the shift in views on how knowledge can be evaluated is now becoming more oriented towards process than result. Teachers can intervene in textual production and help pupils improve their texts. This is quite contrary to the traditional method of grading final documents pupils have written to the best of their abilities, which entails a substantial shift. This may well be an improvement, but still, there is a danger the new technology affords this shift all too easily without allowing the teaching profession time to reflect on the educational consequences.

The new view of knowledge could actually be legitimized through pedagogical theories associated with formative assessment (Nicol and Macfarlane-Dick, 2006; Sadler, 1989). According to these theories pupils should be given constant feedback to works in progress. However, the move toward formative assessment should arguably be the result of intense pedagogical discussions rather than as a by-product of the technological shift. Although the practice of feedback on works in progress was frequently mentioned in interviews, we could not find similar discussions from pedagogical viewpoints relating to formative assessment or other similar schools of thought.

A possible disadvantage is that the teacher can become a handy "crutch" for pupils thus limiting their abilities to develop skills in making strategic decisions on the development and refinement of their own texts. In a Foucauldian perspective (Michael and Still, 1992), teachers are afforded a panopticon

viewpoint of the work processes of pupils. This might lead to processes of self-disciplining, as pupils know everything they write can be scrutinized and evaluated by people wielding substantial power over them.

The usability affordance, to create learning material in Google Sites, was both perceived as a possibility and as a problem. This became an interesting example of a challenge to the monopoly of GAFE since it supplied an alternative to the existing Web portal, where collective learning resources were accessible and expected to be used by the teachers and pupils. These resources were expected to reduce the time teachers needed for preparations and thereby increase the time they can spend with pupils. Google Sites was therefore not accessible at all schools. At one school, where Google Sites had been accessible, the IT teacher feared to steer the teachers away from using it:

I'm reluctant to tell the teachers: "now we're going to use [the Web portal system], where you can share documents with each other." "Oh well, they'll say, what about Google?" "No, not Google. It doesn't work in the same way." "But we've just learned Google [Sites]." They're going to be fed up. (11)

On the other hand, the CIO was critical of Google Sites as it supported the teachers' own educational solutions, enabling them to create their own learning materials. In the CIO's view this did not necessarily lead to the level of quality the school strove for. The reason was a fear teachers would develop separate representations of technology not supported by the overall educational philosophy of the school. The head of educational development feared learning resources would be created that were not shared with all teachers.

In relation to *information management*, GAFE was perceived to be easy to use and consistent, thus affording:

- collaboration
- dissemination: documents and information
- organisation: easy access to educational material and personal documents: facilitating the organisation and findability of information, as well as simplifying teachers' administration of pupils' work: for instance the management of group submissions
- permissive storage: limitless storage space

We interpret all these affordances as functional rather than usable, since we have not found any evidence of individuals developing uses that were not built into GAFE's basic functions.

While the affordances were perceived by all respondents as positive, affordances that could represent difficulties to management or staff included:

- lack of overview: the organisational information in teachers' personal accounts becomes more difficult to overview
- loss of control through sharing: uncontrollable sharing of information
- loss of control of content: individuals can change or erase common information
- vulnerability of access to sensitive information: individual staff members can store sensitive information in the cloud where it can be accessed by third parties

Most of these difficulties related to the shift from hard disk to tethered appliances, where the organisation did not have its files stored on its own devices. Particularly, the CMS manager commented on the lack of control of content, since there is only a link to the document, not the document itself, "... it is, of course, possible to save all the files on a single board, but we take for granted it just works. So file management has been a stumbling block" (15). Furthermore, the CMS manager was aware of the expectations created by the use of Google Sites and its consequences for the Web portal, where learning resources were managed. The use of GAFE also challenged the functionality of the Web portal and the CMS, since it enabled new and easier ways to share information, through linking. The CMS manager described the teachers' reactions after their GAFE education:

Then, all of a sudden, we had a whole bunch of teachers, enthusiastic about creating their own workflows and documents and stuff in Google Apps. [...] Before, you had to write a long list with all the information [for pupils] in the Content Management tool, but now you just add a link to the document in Google Drive. Then there are other technical solutions to integrate your document in a different way on the Web portal [...] The good thing about Google Apps is staff can share documents with each other and quickly make changes. You could do that before, but somehow the threshold has been lowered. I think Google has worked a lot to make it easy to use the product. (15)

In summary, the perceived affordances involve powerful and enabling new practices both for teachers and pupils. GAFE is a technology that clearly can be used to facilitate educational practices. At the same time, previous offline activities are increasingly complemented with online, digital activities emphatically positioned within the digital enclosure (Andrejevic, 2007) where they can be stored, organized, managed and processed for diverse needs. To be noted is that GAFE is inserted as a

mediator between teachers and pupils. Schools do not only transfer knowledge and skills, they also serve as important standard-forming institutions. The teacher does not only educate, but is also required to evaluate pupils' achievements. GAFE intervenes in this precarious balance of knowledge and power.



7. Discussion

This study is timely, since it investigates how the affordances of GAFE are perceived before it becomes domesticated and so taken for granted that it becomes difficult to examine.

In the interviews, GAFE was referred to as usable, *i.e.*, facilitating the realization of users' own ideas and catering for their needs, especially in relation to educational issues. Concerning affordances related to technological and information management, which are less central to teachers' professional competences, functionality was most referred to. Constraints in the use of GAFE were perceived to lie within the organisation. Headmasters', superusers' and teachers' knowledge of and attitudes toward GAFE and its implementation were thought to affect use and also generate differences between schools in the organisation, as well as between individual teachers and pupils in the same school.

According to Gibson (1979), individuals' perceptions of affordances stem from their own premises, interests, experiences and objectives etc. The different people involved in the study highlight different affordances. The CIO (13) emphasized IT in relation to education, while the head of educational development (14) was more interested in educational merits. The IT teacher (11) emphasized how teachers could use GAFE, while the CMS manager (15) foregrounded information management issues. The IT manager (12) was concerned with technology issues, while the CEO (16) emphasized technological affordances in relation to economic consequences.

Despite the legal risks of using GAFE in education, it was implemented due to its functionality and was perceived successful in relation to the technological needs of education. The head of educational development seemed to perceive GAFE both as a neutral tool and as a tool that was forming social interactions. Teachers can tailor their use of the tool to meet new dimensions and requirements in the curriculum, change the ways in which teaching is executed, make learning processes visible, change how feedback is given, etc.

When introduced into an organisation, computer-based technologies tend to embody set notions about what work — in this case education — is and how it should be executed. At the same time, choices are available to organisations and the people within them (Zuboff, 1988). Judging by the results, this possibility does not seem to be well reflected on by educational and management staff, as they perceived GAFE as a neutral tool. Interestingly enough, it seemed quite obvious to the IT professionals that technology would change educational practices.

Jones (2015) argues that technologies in education, and in general, are "a site of social struggle" [3]. Technologies can therefore never be neutral, but are involved in the struggle. Several power struggles could be identified within the organisation studied. Of particular interest are the internal discussions related to Google Sites, which was not generally available in the organisation as a whole, just in some schools. Its use challenged the production, control and access of learning material in the organisation. In Google Sites the teachers could create their own learning material over which the organisation had no control, neither with regard to quality nor to how it was used. Educational material could be withheld or spread only to chosen colleagues, rather than shared via the common Web portal, which made learning resources available to all teachers. This tension was touched upon in almost all of the interviews and clearly shows the struggle between the individual teacher's freedom to use the technology for his or her own purposes and the requirement to follow organisational guidelines. The IT teacher was uncomfortable about restricting teachers' use of Google Sites, since they now were used to it and had found it much easier to work with than the Web portal. Interestingly, the IT department that initiated the implementation of GAFE felt a loss of control over how GAFE came to be used. Most probably, the tethered platform of GAFE nonetheless will afford unexpected generativity (Zittrain, 2008).

While the issue of IT professionals' predominant position with regard to the implementation of GAFE was frequently discussed, we found no discussion on the issue of teacher control over pupils. This is striking, as teachers' possibilities to control are an instantly recognizable affordance of GAFE. At the same time, a certain fascination is expressed in how digital indicators reveal pupils' learning processes and it was argued tests could be made superfluous. Here we see a lack of recognition of the negative affordances of GAFE. To choose to discuss only the positive effects is an example of a tunnel-vision affordance. We define tunnel-vision affordance as the process of being seduced by affordances that enhance professional practice to such an extent the user becomes blind to larger societal aspects or to features relating to power and control. We would argue this process could be more frequently observed in cultures where technology is regarded as an unproblematic and neutral tool. Therefore, it is of some importance that the current study investigates a Swedish case. Sweden is a country Inglehart and Welzel (2010) has recognized as least concerned with traditional values and most concerned with rational values, in comparison with 52 countries/societies in the world, mapped between 2005 and 2007 [4]. Rational choices are more valued in relation to traditional, which further

explains the results, *i.e.*, more focus on how technology furthers educational processes, rather than on more traditional values such as personal integrity. This observation can further be confirmed by the results of a study of Swedish principals' perceptions of cloud computing. The benefits were high compared to the obstacles (Lim, *et al.*, 2015).

The affordances discussed here are not specific to GAFE or other cloud services. Gulliksen, *et al.* (2003) and Nolin and Byström (2010) have identified problems involving the implementation of IT solutions. Arguably, the same difficulties remain, although implementation takes on another dimension since it leaves the organisations in the hands of a powerful commercial actor, such as Google. Eric Schmidt (former CEO of Google) and Jared Cohen point this out succinctly:

We believe that the modern technology platforms, such as Google, Facebook, Amazon and Apple, are even more powerful than most people realize, and our future world will be profoundly altered by their adoption and successfulness in societies everywhere. These platforms constitute a true paradigm shift, akin to the invention of television, and what gives them their power is their ability to grow — specifically, the speed at which they scale. Almost nothing short of a biological virus can spread as quickly, efficiently or aggressively as these technology platforms, and this makes the people who build, control and use them powerful too. [5]

Furthermore, GAFE is easily accepted, particularly as its affordances are multiple in comparisons with similar IT solutions. Additionally, also individuals commonly use the technology at their leisure. The technology is broadly known and the brand is popular.

The teachers did not push for GAFE. Rather, it was seen as of purely technical concern. As the department for educational development at the school saw GAFE mainly as a generic tool that would not affect teaching particularly, they did not initiate the implementation process. Eventually, however, they became involved in negotiating certain details in the final stage of implementation.

The way education is practiced can affect the use of the technological tools, or — the other way around — technology use can affect teaching. In line with Gibson (1979), the issue involved is not the question of the hen or the egg, but that education and tools form a seamless ecology, where affordances are perceived in connection to the wishes and interests of the actors, in this case the teachers.



8. Conclusion

The results of this study support Zittrain's (2008) fear that users prefer the security and convenience of a tethered appliance to the wider technical possibilities offered by the personal computer or the Internet.

When implementing new technologies, creative use can lead to unforeseen consequences. As we can see from this study, there is an attempt by management to stop teachers from using GAFE's Google Sites for their own initiatives, since it is not in line with the organisation's educational objective. What we see here is a conflict between managerial control and the individual teacher's desire to produce her/his own teaching material in a simple well-functioning way. Thus, individuals identify more affordances in GAFE, than the organisation does. In the current case study we have seen an organisation restricting technology use for reasons of control. Furthermore, individual teachers with an interest in IT creatively develop new ways to use the technology. At the same time, while the individual affordances in relation to GAFE may seem to support professional creativity, there is the issue of a commercial actor ultimately controlling both the individual and the organisational material, disciplining staff and students alike in using its services.

By all accounts, GAFE offers substantial advantages to many teachers in terms of educating pupils, as well as in administering and assessing pupils' schoolwork. Despite these advantages, it is important to critically scrutinize what is at stake. GAFE can be seen as a system for standardizing human behaviour. The affordances of the applications include implementing a system of rules for teachers and pupils alike. This is congruent with the already well-established institutional function of schools to grade and rank pupils. In this way, GAFE extends and strengthens the intertwining of power and knowledge. GAFE not only reinforces existing structures but it also removes agency from teachers and school boards.

GAFE creates both a synchronic and diachronic lock-in. As pupils are educated according to the goals of the Swedish educational system, they are also trained into becoming Google users. This is a process of domestication in which the use of diverse Google software becomes taken for granted. After graduation, they will continue to use Google applications in all probability as they are used to them. Promotion of this kind of "Google citizenship" is a larger democratic issue that might not be best treated as an unproblematic issue of great economic value for various schools' boards or, for that matter, municipalities.

We found that teachers perceive generic IT, like GAFE, as a relatively unimportant component in learning compared to customised educational resources. The perception of a technology as neutral easily lends itself to the conclusion that its implementation and use is of no interest whatsoever. The decision on whether or not to implement GAFE is therefore regarded as non-problematic and best left to IT staff, as experts on IT.

Building on Orlikowski (1992), as well as many other constructivist studies (*e.g.*, Zuboff, 1988; Leonardi and Barley, 2010), there are several different ways of considering what a technology is and how it can be used, depending on a person's or organisation's interests, practices, experiences, aims, skills, engagement, etc. The implementation and use of new technology is complex and messy. Accordingly, there is a need to understand the technology as embedded in its specific social setting. Following Jones (2015), who states that "[t]he affordances of technology do not reside in essential features of socio-technical assemblages, rather they are found in the relationships between assemblages and those that use them" [6], we argue that the implementation of Google-based, surveillance oriented technology within schools constitutes a special case with added dimensions of complexity. In our empirical material, as discussed in this paper, we can identify five manifest or latent power struggles:

- Google vs. the school
- IT professionals vs. teachers
- Management vs. teachers
- Teachers vs. pupils
- Google vs. pupils

Highlighting any of these struggles may well serve to distract attention from the others. In some cases, the internal power struggles would force attention away from overreaching societal, ethical and political issues involved with tethered appliances. This distraction, in turn, would strengthen the embeddedness of the phenomenon of tunnel-vision affordances, a concept that has been introduced in this article. This conceptual contribution makes it possible to identify one more dimension of the complexity of the implementation of technology.

Technology affects how things are perceived, how things are done and how possibilities to do things are envisaged. Therefore, it is obvious to us that educational concerns should guide the implementation of new IT in schools, and not primarily economic and technical considerations. Furthermore, security, privacy and legal concerns are additional challenges that emerge in relation to cloud services. As the study shows, IT staff had these concerns, but it is equally obvious the non-IT strategic staff were unaware of the need for their involvement in IT implementation. Google differs from other IT suppliers, with visions that greatly transcend the educational requirements of functional educational IT. 

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Notes

1. Raudaskoski, 2009, p. 178.
2. Raudaskoski, 2009, p. 179.
3. Jones, 2015, p. 333.
4. Inglehart and Welzel, 2010, p. 554.
5. Schmidt and Cohen, 2013, pp. 9–10.
6. Jones, 2015, p. 345.

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