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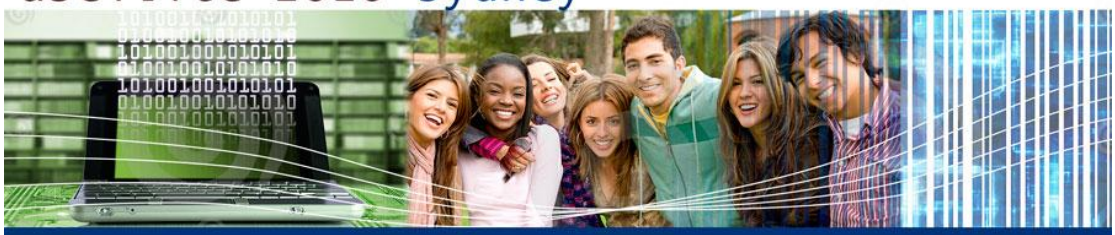

Knowledge building in 21st century: Learners, learning and educational practice

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The integration of the Internet and mobile learning devices in blended and face-to-face (f2f) teaching and learning is not a 21st century invention. For many decades teachers and instructors have sought the best technologies for their students in order to offer enriched learning pedagogies with the most recent forms of technology. Recent literature on the so-called millenials purports that Generation Y prefers mobile learning and VLE to f2f learning and teaching methods because they have grown up learning and living with them (Oblinger & Oblinger, 2005; Howe & Strauss 2003; Lancaster & Stillman 2002). It has also been noted in the research about the 'new' higher education student that they seek to learn anywhere, any time to fit learning into their schedules (McLoughlin & Lee, 2009). This led to discourse into the digital divide and Prensky's (2001) reference to the 'digital native'. This current generation of undergraduates in the western capitalist world has grown up with the Internet, digital technologies and second and third generation mobile phones. Many have however, only been introduced to this technology as a learning device when they entered university, only in the last few years have they experienced Learning Management Systems (LMS) in schools. This paper will argue however that despite the increase of technology into the daily lives of Generation Y, many students in higher education may not be as widely supportive of the idea of integrating this technology including their social networking systems into the f2f classroom as has been recently presumed.

Keywords: online learning and teaching, higher education eLearning, Net Gen, Generation Y, obstacles to elearning

Introduction

The scare tactic short films and adverts by Microsoft about students having to leave their knowledge at the door and enter 19th Century style 'chalk and talk' classrooms has had an effect. This has led higher education instructors, and in recent times many secondary school teachers, to believe they had been left behind, having ignored the opportunity of integrating new eLearning material and devices into the classroom to ignite their students' learning. Pedagogy for good teaching has always led the curriculum and syllabuses, when did the use of new technologies take over from pedagogical developments in learning and teaching? Rather, effective educators seek to embed and integrate learning experiences and knowledge building into the pedagogy. Good teaching practice in higher education is typified by student and teacher knowledge sharing (McLoughlin, 2004; Biggs, 1999), where student learning has real world relevance (Cronin, 1993; Jonassen, 1991) is supported by the teaching and authentic assessment (Herrington, Reeves, Oliver, 2010). In more recent years it has however, often been characterized more by grades, assessment and accountability. As Entwhistle, Entwhistle and Tait (1993) conferred, "providing a constructivist teaching environment will have little effect on the quality of learning while conventional assessment procedures remain in place" (p.353). This prevailing assessment driven form of education has allowed elearning to be used broadly as a term to encompass

online quizzes and discussion forums (DF) as a form of assessment. As Herrington, Reeves and Oliver (2010) argued, "technologies need to be used as cognitive tools for learning rather than as simply alternative delivery methods" (p.3). There is a body of evidence in higher education that the pedagogy must lead the technology, where various forms of assessment and instruction in the learning space allow for a shared learning community of practice both online and f2f (Herrington, Reeves & Oliver, 2010).

The developed nation's 21st century student sits generationally in a cohort characterized by shared experiences that are centred around digital technology and the internet, which are embedded into their social lives and recreational activities via mobile learning devices and web 2.0 (Hunt, 2007; Livingstone, 2006; Prensky, 2001). More recent research has put forward that these learners may not be as tech savvy and engaged in learning activities as originally believed, the National Survey of Student Engagement (NSSE) indicated that "undergraduate students are much less engaged in learning activities known to foster academic achievement than expected" (Herrington, Reeves, Oliver, 2010, p104). As Hargittai (2010) furthers, the assumptions that students "who have grown up with digital media are often assumed to be universally savvy with information and communication technologies," (p.92) are rarely grounded in empirical research. Twenge's (2006) longitudinal generational study indicated significant differences in Generation Y as learners and workers, where "after a childhood of buoyancy, GenMe is working harder to get less" (p.105). Evidenced in the NSSE data, there has been a paradigm shift in the reality of undergraduate study patterns in this generation, where only "20% of students spend less than five hours per week studying, 25% spend 6-10 hours per week, 48% spend 11-30 per week, and only 7% exceed the 30 hours per week expected by their teachers" (Herrington, Reeves & Oliver, 2010 p.104). Promoting effective and engaging learning and teaching strategies for students' academic achievement is of paramount importance, technology should be wisely used to enhance and encourage this, not disrupt it. Even though many educators in higher education embrace technology it is imperative that educators assess objectively how it can be utilized to "optimise the teaching and learning process, rather than being seized and used as technology for technologies sake" (Ryder, 2007, p.155).

Should we as educators acknowledge Generation Y's preference for, and familiarity with, digital technology and allow it to figure predominantly in teaching and learning? Recent research has suggested that even though current students' access and use of computers and technology is high "they don't necessarily want or expect to use these technologies to support some activities, including learning" (Kennedy, G., Dalgamo, B., Bennett, S., Gray, K., Waycott, J., Judd, T., Bishop, A., Maton, K., Krause, K. & Chang, R. 2009, p.6). This maybe a result of the fact that technology can often be poorly utilized in teaching in higher education as an information provider rather than as a teaching and learning tool that engages the student in the learning process. Information technology and communication (ICT) integration into education is vital for educating life-long learners who see the power in knowledge and how the Internet in particular can enhance knowing through common communities of practice. Web 2.0 and social networking has further offered students and researchers a space to seek answers and find support for and the construction of newly acquired learning. As Herrington, Reeves & Oliver (2010) confer, "authentic eLearning is especially powerful with respect to the role of assessment in relationship to conative as well as cognitive, affective and psychomotor outcomes" (Herrington, Reeves, Oliver, 2010 p.106), which helps students learn.

Much has been reported in the media on the onset of skilled up technological natives entering higher education. It has also been proposed that Generation Y have different brain capabilities and the ability to parallel-process and multi-task. As a result, educators should allow students to use laptops in lectures and tutorials, and use ipods/ipads while in lecture theatres; thereby providing millenials with the ability to listen, takes notes and have access to instant research opportunities on an ongoing basis (Hunt, 2007). There are no doubt many positive reasons for the further integration of ICT into teaching and learning, however it must be taken into account that our cognitive architecture where the mental processes of memory, learning and problem solving take place have not necessarily changed to 'keep up with the times'. This includes the factor that the capacity of our working memory's ability to simultaneously hold and process information while multi-tasking may be limited. For the human memory may have a limited capacity to simultaneously hold and process information while looking, listening, taking notes, etc (Sweller, 1988). Using computers in a lecture situation to connect to the Internet can be a distracting and counter productive exercise, especially as students with technology in front of them for note taking can become easily distracted. This however, is not really different from the scribblers and doodlers in notebooks present in all classes; however, taking this into account it is

imperative that educators in higher education use the inherent technology to engage learners with the learning process as well as to promote collaboration and interaction in the learning space.

Generation Y is the first generation to spend their leisure time in the participatory WWW and sharing friendships in web 2.0 rather than watching television or going to parties. It was initially thought that the way to enrich and engage these digital students was through online instructional learning platforms such as LMS, as these students now spend enormous amounts of time online in order to be connected to each other. As educators we should ask when utilizing LMS in our teaching are we engaging this generation of learners in learning rich tasks and authentic learning experiences? As Web 2.0 and its attendant technologies continue to open doors to new engaging and enriching spaces in the learning and teaching settings and learning outcomes continue to advance as more learning opportunities become accessible have many educators embraced technology without considering what has been left behind? As Herrington, Reeves & Oliver (2010) suggest, technological tools "must be viewed as secondary to instructional design" (p.110).

The learning opportunities of the digital native as Prensky (2001) referred in his digital native argument have been reassessed by the author in recent years (Prensky, 2009) as higher education came to the realization that the emphasis based on blended and fully online learning and teaching was not without its problems. An assumption by educators that the digital divide was to blame for students' disengagement from traditional face-to-face (f2f) methods led to a top down approach to the roll out asynchronous computer mediated communication (CMC). This constructivist-learning tool however requires, as do all constructivist environments, an expert to lead the field of study and facilitate the learning space. In particular it requires a pedagogical outcome of a blended and fully online learning space that teaches, motivates, interacts and supports students learning. Learning management systems (LMS) and virtual learning environments (VLE) have been integrated increasingly to provide a pedagogical framework for learner-centered and reflective dialogue. These instructional learning and teaching approaches are believed to require learners to take more of an ownership of their learning rather than taking notes passively in a lecture situation. This approach to learning in higher education has however, meant that students are often required to learn to learn online simultaneously while learning to learn. The design of the online learning space as well as the facilitation and (e)moderation (Salmon, 2003) are imperative for active engaged learning. The assumption that our current generational cohorts want to learn online because they are 'digitally native' is only beginning to be questioned. This paper will report the first stage of a study conducted with undergraduate students to gauge if they support the use of technology including their social networking systems into the f2f classroom. It will also investigate whether Generation Y not only have access to and understand using technology to learn in higher education but whether they have found there are barriers to overcome in order to fully utilize technology for learning.

A study of Generation Y's preferences for utilizing technology for learning

It has been suggested that given the high accessibility of information available on the internet, that the 21st century student tends to have zero tolerance for delays (Oblinger, 2003), vary their attention span according to their level of interest and they often parallel-process and engage in multiple activities in tandem (Ericsson, 2008; Hunt, 2007; Oblinger, 2003). It has also been suggested that this generation has a limited attention span and that younger students "feel constrained by inactivity…they want constant, interactive, often visual stimulation" (Hinton & Manathunga, 2001, p.40). While access to knowledge maybe important for this generation, "knowledge (is) no longer perceived to be the ultimate goal" (Oblinger, 2003, p. 40) as they have witnessed new knowledge constantly replacing old knowledge on the internet. Taking these factors into consideration it is easy to understand the reasons why the 21st century teacher has made presumptions about their student cohort's preference for using technology in the classroom. As the authors are currently questioning the use of technology for learning in their undergraduate classes, even though they have for many years successfully utilised LMS in Postgraduate courses, it seemed prevalent to first gauge the student's perspective on this issue, the initial results of Stage one of this investigation will be briefly outlined.

Study aim

This study aims to further extrapolate the assumption that Generation Y users of technology are digitally literate and as a result they are prepared to welcome online learning and teaching in their

tertiary studies. It examines the presumptions that students of the net generation also embrace the notion of using LMS and social networking technologies to support and enhance their learning in higher education.

Methodology

For stage one of this study, a questionnaire was utilized as an information gathering method that provided both quantitative as well as qualitative data which was useful for gauging students' views on the use of technology in higher education, and their opinions on its usefulness for learning in the tertiary classroom. This provided a succinct data gathering method that was economical in time spent and non-specific enough that it allowed students to openly express their views on the issues raised, particularly as it did not refer to specific courses students had undertaken. The questionnaire asked for information in seven areas, it asked about the participant's background, including age, gender and student enrolment. In order to provide sufficient structure and focus to this study, the authors isolated six areas of inquiry that indicate a student's digital literacy which correlate with a student's utilization of the online learning environment. Students were provided with a hard copy survey with multiple choice and open-ended questions.

Questions were developed around technology uses and access, these included:

1. *What is your access to the Internet in your place of study?* Evaluated by the responses: unrestricted, limited and none.
2. *What is your usage of mobile phones for: SMS, Phone, Camera, personal organizer, send media, MP3, Internet, email.* Evaluated by the responses daily, weekly, occasionally and not used.
3. *What do you use the Internet for: email, general information, instant messaging, entertainment or leisure, LMS or VLE, study, general services, buy or sell goods.* Evaluated by the responses daily, weekly, occasionally and not used.
4. *How often do you: use the internet to access University-based services; access or download online recordings of supplementary content, receive alerts about course information via RSS, use instant messaging to interact with other students in your course, use instant messaging to interact with teaching and administrative staff, share course related files,* Evaluated by the responses: daily, weekly, occasionally and not used.
5. *Do you consider any of the following an obstacle to your learning?* Evaluated by responses to: Insufficient number of computers for student's use at University, LMS not integrated into classroom instruction practices and learning effectively, problems in scheduling enough computer time for learning, internet connection not available – not always available, lack of interest/willingness of lecturers/tutors to use computers, lack of funds/money to purchase the technology you require for your learning.
6. *Which are the three most serious obstacles to using technology in learning?*

Participants

Students enrolled in the Bachelor of Design, a four-year undergraduate degree offered at the University of New South Wales, College of Fine Arts, were asked to volunteer to participate in this study. The sample size consisted of 144 undergraduate students with 123 female and 21 male students. Generationally they represented the Net Gen (Oblinger & Oblinger, 2005) demographic, they were aged between 18 and 27. Participants were divided into four groups based on the Generation Y demographic age: 18-20 years old, 21-23 years old, 24-26 years old, and 27 years old and over. The cut off age for Generation Y's was 26, as below this age is considered to be born into the age bracket of the millennial or Net Generation (Oblinger & Oblinger, 2005; Howe & Strauss 2003). Of the participants 84% were local and 16% were International students.

Results

As presumed about this Net Generation, they respond as high users of digital technology with 83% of students having unrestricted access to the Internet in their place of study. 14% of students have limited usage and 3% have no access in their personal place of study. Mobile phone usage patterns all indicate

that of the Generation Y's questioned 92% use their phone for SMS on a daily basis with 74% of the student participants using their mobile for making phone calls. Other functionalities or applications that smart' phones contain do not rate high in usage, such as camera, calendars and personal organizers. Only 42% of students surveyed use their camera phone occasionally, 41% of students never use their mobile phone organizer. 69% of participants access the Internet on their mobile on a daily basis, 23% did not have Internet access on their phones. 61% of students read or sent emails on their phones on a daily basis, where 27% did not have this capability. Issues arising from this study on undergraduate digital literacy include access to the Internet for learning purposes. Although 83% of respondents have unrestricted access to the internet only 53% of students surveyed use the internet for study on a daily basis, 20% for LMS or VLE learning and teaching and 42% on a weekly basis. User satisfaction of Internet based learning and teaching plays an important role in the further examination of the data, obstacles to learning as stated by surveyed participants included lack of access to University computers and appropriate software packages for design students, lack of funds to purchase the software packages and social networking sites such as facebook as distractions.

Data analysis and discussion

Prensky (2009) now concurs there is a less generational distinction and digital 'know how' between the learning generations in our Universities. As Prensky (2009) referred to the 'digitally wise' student as knowledgeable in the use of Internet and mobile learning devices particularly if they utilize these on a daily basis, LMS and VLE on the other hand were unknown areas of the Internet that many students had little time available to learn how to use. It has also been acknowledged that students were apathetic about using LMS when there were no grades or marks attached and they were discouraged from using discussion forums when there was no apparent reason for doing so (Kennedy, G., et al. 2009).

This study found that only 53% of participants used the Internet for university study, a lot lower percentage than expected. Previous study by O'Hanlon (2002) suggested that this could be because many university students had inadequate Internet skills for searching and evaluating relevant and useful websites for study. However, O'Hanlon (2002) is on the periphery of fitting the Generation Y profile hence it is not unreasonable to consider that after nearly a decade on this generational cohort would be as 'tech savvy' as many assume. In fact this study discovered the opposite, only 17% of participants used their LMS for learning occasionally and 22% never utilized these at all. This relates to the findings in Question 6, where the highest listed obstacle amongst both male and female students was the fact that there were an insufficient number of computers available for students use at University. However, if there were one computer per student at university would students access computers more for their learning or would they continue to use them instead as social networking tools?

Facebook in this study, was listed a number of times as an obstacle to learning by local, International, male and female respondents, in particular acknowledging that it was a distraction to online learning and studying. Another obstacle that participants noted was that LMS were not in their view effectively integrated into classroom instruction and learning. As expected the majority of Generation Y (92% of the participants questioned), used their mobile phone for SMS on a daily basis and there was a belief by some educators in higher education that this technology should be utilized as a teaching and learning tool (Herrington, Mantei, Herrington, Olney & Ferry, 2008; Herrington & Herrington, 2006).

M learning or learning using mobile devices has recently become a popular technology to explore for teaching and learning in higher education. Prensky (2005) recommended that educators "should bear in mind that cell phones can be used for context as well as content", suggesting that: "just as we are designing and refining Web-based tools for such tasks, so must we be designing similar tools for cell phones" (p.8). Geser (2004) however suggested that there was evidence that Net Gen's actually resented this social networking tool being used for teaching and learning, particularly as it may not be cost effective for students. As educators we should always keep in mind the importance of the pedagogy leading the technology not the other way around (Rourke, Mendelssohn & Coleman, 2008).

Conclusion

Bond, Fevyer and Pitt (2004) concurred that in order to manage student's expectations before they enroll in a course, universities should informed applicants about elearning requirements. This could

include supplying potential applicants with a list of any computer skill and software know-how requirements so that there is a possibility of addressing this expectation before entering tertiary studies. This however could further marginalize less socio-economically advantaged students who have less access to the latest technology and software as a result they will be even more reluctant to apply for courses requiring a high level of computer literacy. In the past it was IT and computer graphics courses that required the student to be 'tech-savvy', increasingly now elearning has entered in some form or other in the more traditional 'chalk and talk' courses as a result it is often taken for granted that the Net Gen will not only cope but excel at using and engaging in the internet as a study and learning source. For Prenksy (2009) this issue of "digital wisdom is a twofold concept, referring both to wisdom arising *from* the use of digital technology to access cognitive power beyond our innate capacity and to wisdom *in* the prudent use of technology to enhance our capabilities" (NPN). The need for participatory pedagogy (McLoughlin & Lee, 2009) alongside developing student's digital wisdom is imperative if student online presence is to enhance their learning.

One of the important challenges for higher education in the 21st century is to consider how it could create better access to quality educational practices for those who are disadvantaged economically, geographically and socially when learning in the digital age requires a high level of financial support as well as 'tech savvy' know-how. If the responses to this studies Stage one questionnaire are anything to go by there is an uphill battle ahead of us as even the more economically privileged Generation Y struggle to see the relevance and necessity of using technology for learning in higher education. This paper has reported stage one of an investigation into student's preference and perceptions of the use of technology for learning in higher education. The authors will be exploring further in other stages of this study this generations learning technology needs as well as the learner and the educators' perspectives on the role of technology for learning in the future. Due to limitations of the study, care should be taken in generalization of results to other learning environments.

References

Biggs, J. (1999). Teaching for quality learning at university. Oxford: Society for Research into Higher Education and Open University Press.

Bond,C.S., Fevyer D. & Pitt, C. (2004). Student reactions to online tools for learning to use the Internet as a study tool: Outside the comfort zone? In R. Atkinson; C. McBeath; D. Jonas-Dwyer & R. Phillips (Eds.) *Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference* (pp.134-140). Perth, 5-8 December. http://www.acsilite.org.au/conferences/perth04/procs/bond.html

Cronin, J.C., (1993). Four misconceptions about authentic learning. *Educational Leadership*, 50(70), 78-80.

Entwhistle, N., Entwhistle, A., & Tait, H. (1993). Academic understanding and contexts to enhance it. In Duffy, J. & Jonassen, D.H. (Eds) *Designing environments for constructive learning* (pp. 331-357). Heidelberg:Springer-Verlag.

Ericsson. (2008). *Broadband consumers: Perspectives paper*. Stockholm, Sweden: Ericsson.

Garcia, P., & J. Qin. (2007). Identifying the generation gap in higher education: Where Do the Differences Really Lie? *Innovate* 3 (4). http://www.innovateonline.info/index.php?view=article&id=379

Geser, H. (2004). *Towards a sociological theory of the mobile phone*, University of Zürich, http://socio.ch/mobile/t_geser1.htm#7.2

Hargittai, E. (2010). Digital Na(t)ives? Variation in Internet Skills and Uses among Members of the Net Generation, *Sociological Inquiry*, *80*(1), 92-113.

Herrington, A., & Herrington, J.(2006). What is an authentic learning environment? In A.J. Herrington, & J. Herrington (Eds.), *Authentic learning environments in higher education* (pp. 1-13). Hershey, PA: ISP.

Herrington, J., Mantei, J., Herrington, A,. Olney I., and Ferry, B. (2008). New technologies, new pedagogies: Mobile technologies and new ways of teaching and learning. In *Hello! Where are you in the landscape of educational technology? Proceedings ascilite Melbourne 2008*. http://www.ascilite.org.au/conferences/melbourne08/procs/herrington-j.pdf

Herrington, J, Reeves, T.C & Oliver, R. (2010) A Guide to Authentic e-learning. Routledge, New York and London.

Hinton, B. & Manathunga, C. (2001). The Mobile Phone. In Edwards, Smith & Webb (Eds.) *Lecturing, Case Studies, Experience and Practice*. London: Kogan Page.

Howe, N., & Strauss, W. (2003). *Millennials go to college*. New York: LifeCourse.

Hunt, K. (2007). Teaching the iGeneration. Retrieved 10 August 2009, from http://www.yorku.ca/zorn/files/DZ,_Globe_Oct_07.pdf
Jonassen, D., (1991). Evaluating Constructivistic learning. *Educational Technology*, 31(9), 28-33
Kennedy, G., Dalgamo, B., Bennett, S., Gray, K., Waycott, J., Judd, T., Bishop, A., Maton, K., Krause, K. & Chang, R. (2009). *Education the Net Generation, A Handbook of Findings for Practice and Policy*, Strawberry Hills: Learning and Teaching Council, Australian Government Department of Education, Employment and Workplace Relations.
Lancaster, L. C., & Stillman, D. (2002). *When generations collide*. New York: HarperCollins.
Livingstone, S. (2006). iGeneration. *London School of Economics: Focus Newsletter, Autumn*, 1.
McLouhglin, C. (2004). Achieving excellence in teaching through scaffolding learner competence. In *Seeking Educational Excellence*. Proceedings of the 13th Annual Teaching Learning Forum, 9-10 February 2004. Perth: Murdoch University. http://lsn.curtin.edu.au/tlf/tlf2004/mcloughlin.html
McLoughlin, C. & Lee, M.J.W. (2009). Personalised learning spaces and self-regulated learning: Global examples of effective pedagogy. In *Same places, different spaces. Proceedings ascilite Auckland 2009.* http://www.ascilite.org.au/conferences/auckland09/procs/mcloughlin.pdf
Oblinger, D. (2003). Boomers, Gen-Xers and the Millennials: Understanding the new students. *EduCAUSE Review*, 38: 37-47.
Oblinger, D. G., & Oblinger, J.L. (2005). Is it age or IT: First steps toward understanding the Net Generation. In *Educating the Net Generation*, ed. D. G. Oblinger and J. L. Oblinger, 2.1-2.20. Washington, DC: EDUCAUSE. http://www.educause.edu/educatingthenetgen
O'Hanlon, N. (2002). Net Knowledge: Performance of new college students on an Internet skills proficiency test. *The Internet and Higher Education*, 5(1), 55-56.
Prensky, M. (2009). H. Sapiens Digital: From Digital Immigrants and Digital natives to Digital wisdom. *Innovate: Journal of Online Education*, 5 (3). http://www.innovate.info/index.php?view=article&id=705
Prensky, M. (2005). What can we learn from a cell phone? Almost anything! *Innovate*, *1*(5).
Prensky, M. (2001). Digital natives, digital immigrants Part 1. *On The Horizon*, *9*(5), 1-6.
Rourke, A. J. & Coleman, K. (2009). An emancipating space: reflective and collaborative blogging, *ASCILITE*, University of Auckland, New Zealand, 1-10.
Rourke, A., Mendelssohn, J., & Coleman, K. (2008) 'Peer Review and the Coursework Postgraduate student: Two case Studies from the Master of Art Administration at COFA, UNSW, *The International Journal of Learning*, 14 (12), 7-12.
Salmon, G, (2003). *E-moderating: The Key to Teaching and Learning Online*. Taylor & Francis.
Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, *12*(2), 257-285.

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