

# The 5<sup>th</sup> Wave

## Challenges and Opportunities for Mobile-learning in Thailand

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### **Abstract**

*Society is changing dramatically in Thailand through technology and social developments driven by a technological and cultural revolution creating a greater digital divide that is based on technological capability; behavioural constraints in terms of learning needs; and engagement through access.*

*This paper challenges the present notions of m-learning developments in Thai higher education and illustrates how The 5<sup>th</sup> Wave may impact on how management of HE institutions will need to respond in order to move towards providing more appropriate learner-centred patterns of educational provision.*

*Questions and issues are raised that directly relate to The 5<sup>th</sup> Wave consciousness. These include operational, software and behavioural concerns.*

*The paper concludes with a short discussion of the perceived overall outcome from addressing The 5<sup>th</sup> Wave as it may require an overarching, progressivist m-Learning pedagogy designed to engage learners from disparate locations through the appropriate use of technology, software and media.*

**Keywords:** m-Learning, e-Learning, ICT, 5<sup>th</sup> Wave, Higher Education.

### **1.0 Introduction**

Society is changing in Thailand through educational technology and social developments driven by a new techno-

cultural revolution (Adkins, 2003) extending e-Learning towards m-Learning (Pinkwart, 2003) creating an increased digital divide that is based on technological capability; behavioural constraints in terms of learning needs and engagement; and access terms. This popular development (Baldzer et al., 2004) will challenge most individuals involved in the development and use of these new technological configurations in terms of their ideas; views; and future aspirations about e-Learning and through this m-Learning (Quin, 2001) in particular, as universities test out new dimensions of m-Learning relating to pedagogic operational effects (Laouris & Eteokleous, 2005) respecting a developing trend of mobile applications (Falk, 2003) that may encompass most universities in the near future. Mobile-devices for use within the sphere of education has been available for more than 10 years or so (Wayne, 1993), but the significant barriers to its implementation and consistent use, such as cost and technology limitations, have only recently been addressed and to a larger extent mitigated (Bull et al., 2004).

However, m-Learning is an *emerging field* (Wains and Mahmood, 2008) and presently considered by many as innovative (Barker et al., 2005), technically feasible (Kim, 2007), offering possibilities that are seemingly pedagogically sound (Sharples, 2000), and which creates probable opportunities for a sustained and wide-scale deployment (Falk, 2003) in Thai HE. Unfortunately, most researchers appear to be entrenched in a

bitter battle of how best to use e-Learning technologies, whilst m-Learning is presently residing in the realm of *beta-testing* status. The 5<sup>th</sup> Wave introduces the practical notion of what to do with the output from the technology, not focusing on what the technology does. This has implications for management, students, other stakeholders such as parents, for employers, and of course university staff. Underpinning this development is the so called ubiquitous communication; ubiquitous information; and the constant drive of the ubiquitous learning organisation. However, and unfortunately, at present there is nothing ubiquitous about ubiquitous computing!

**Consider this:**

- The majority of individuals in education have no personal access to mobile technology.
- The majority of individuals in business have limited access to advanced mobile technology.
- The majority of children in our schools have limited access to mobile technology.

(And this is in Europe!)

Are we thus deceiving ourselves to think that e-Learning and consequently, m-Learning is inevitable for everyone? Or even desirable? This begs the question - What is it that makes mobile-learning such an incongruous hype? The hype appears to come from the notion that modern technology is new, contemporary and is perceived as fast developing. The popular hype surrounding m-Learning suggests that only young people are involved, whose everyday consciousness concerns networking edits and needs that match their obsession with mobile technology and are often characterised essentially as *digital natives* (Prensky, 2001a) - contrary to Young (2001); and who may engage more enthusiastically with contemporary learning approaches such as m-Learning (Weller, 2008). Whilst this may be an interesting but essentially flawed

contention, it would be dangerous to use this characterisation for everyone engaged in e-Learning today. Not everyone - not even a large minority - is so engaged. However, Bates (2001) claimed that many universities in developing countries may not move towards e-Learning and this may thus offset and reduce the pattern of university engagement in m-Learning practices. In 2002, it was suggested that by 2006, more people would connect to the Internet through mobile-devices than they did using PCs (Beaulieu, 2002). By 2010, some 35 billion mobile devices will connect to the Internet - 6 for each one of us (Electronic Data Systems Corporation, 2008). This is why research into m-Learning is set to gain such a high priority.

There are technological, behavioural and managerial challenges for educational leaders and other stakeholders. In order to bring some focus to the question - What is it that needs to be done to enhance the future learning provision for students and other stakeholders within higher education? The following agenda is proposed:

- Outline the meaning of the term - *mobile devices*;
- Highlight The 5 Waves of Digital Technology Development;
- Discuss The 5<sup>th</sup> Wave of m-Learning;
- Characteristics of The 5<sup>th</sup> Wave;
- The 5<sup>th</sup> Wave - Some Issues;
- The Application of a Possible Model of m-Learning in Universities Experiencing The 5<sup>th</sup> Wave.

## 2.0 What are mobile devices?

Petsas et al. (2001) suggests that mobile devices are often technologies such as personal digital assistants (PDAs); mobile phones; iPods; and also includes such things as web-based systems that support both internet and mobile access. This is seen by some as innovative (Nyiri, 2002) *exotic*

technologies (Kling and Lamb, 1996), reflecting newer and broadening learning channels that seemingly offers organisational flexibility. Ally (2004) defined m-Learning as the delivery of electronic learning materials to mobile devices. Unfortunately, targeting remains one of the ever-present problems of electronic media personalisation developments (Perugini and Ramakrishnan, 2003) through which to deliver appropriate adjustments in learning content provision as flexibility is required as a consequence of heterogeneous mobile technologies relating to student device software capabilities and hardware limitations. Coupled with the technology limitations are the issues surrounding delivery band-width which has an impact on the effectiveness of the whole m-Learning experience – irrespective of the mobile device capability.

Numerous researchers have discussed digital system developments (Petsas et al., 2001; Cheng et al., 2000; Tsai et al., 2000) and have shown how user data can be used to provide appropriate content/information streams that match targeted user learning needs. More appropriate to this paper, Zhang and Shijagurumayum (2003) used the concept of *user metadata* as a profile underpinning the delivery of targeted and customized content to mobile-phone users. This has not been lost in pedagogic developments, as research has focused on how students may be assisted in receiving individualised and personalised knowledge content (Dahn and Schwabe, 2002) whether as assisted learning in the classroom (Carchiolo et al., 2003) or through distance-learning programmes (Qu and Shen, 2002; Dadarlat et al., 2002). Consequently, it may become an operational imperative for some universities to deliver appropriate learning requirements to interested stakeholders/students (Freeman and Thomas, 2005; Lancaster and Reynolds, 2002) directly through contemporary technologies

such as mobile devices (Tapp et al., 2004) as this will be the only way to increase the numbers of students attending university (Tagwireyi, 2000).

However, much of the new developments in e-Learning and particularly in m-Learning will require changes in overall university strategy (Inglis et al., 2002) and possibly result in the future development of a new paradigm in pedagogic operations in Thailand - especially its technological, but also its overall marketing approach (James, 2008f). It will take the Thai university beyond technology change per se, to a more enlightened techno-social ethic based on advanced technology development and engagement. This will ultimately change the structure and orientation of universities as m-Learning facilitates a more interactive experience, and as such this will put pressure on the development of more open and flexible organisational features (Bates 2001).

### 3.0 The 5 Waves of Digital Technology Development

- 1<sup>st</sup> Wave - Cottage System of Education
- 2<sup>nd</sup> Wave - Industrial System of Mass Education
- 3<sup>rd</sup> Wave - The Knowledge Media (Daniel, 1998). The convergence of the learning and cognitive sciences with computing and telecommunications technology.
- 4<sup>th</sup> Wave - Technology focused creating dependent learners. First coined by Pownell and Bailey (2001) and indicated the possible effects of mobile-devices. However, this was still focused on technology.
- 5<sup>th</sup> Wave - Mobile Learning (m-Learning) - Technology transparent - creating independent learners using MID enabled mobile-devices.

These waves have tended to converge and have gained momentum in terms of change

approaches. However, the 4<sup>th</sup> Wave is clearly upon us, with the 5<sup>th</sup> Wave being experienced by some - the potential of which has not been mooted or researched adequately, and this clearly underpins the basis for this discussion.

#### 4.0 Characteristics of The 5<sup>th</sup> Wave

As a consequence of the above, higher education appears to be changing in Thailand (Wilson and Velayutham, 2008) to make educational provision for students more personalised (Kramer et al., 2000), interactive (Chan et al. (2003), responsive (Wong, 2007) and facilitative – using technologies in the same way as expected through students' normal social-networking behaviours. What will be the outcome of these initial effects of The 5<sup>th</sup> Wave on pedagogic provision? Just because there is a social phenomenon for mobile social-group engagement, does this mean that educational management must also follow down this track? What of the cost? – in terms of lost opportunities?, management?, administration?, staff development? The answer unfortunately - if there is one, is rather complex. For example, The 5<sup>th</sup> Wave will undoubtedly influence integrated virtual and face-to-face communities and collaborative needs (Earle, 2002) of any corresponding edu-social groups, which use mobile technologies to enhance their cohesion and pedagogic efficacy promoted through Semantic web or Web 3.0 which probably will become much more commonplace in universities in the near future. However, present research indicates the responses of students ill-prepared for such m-Learning programmes may be less than positive ((Ponzurick, France and Logar, 2000) irrespective of the associated m-Learning hype.

In terms of the university, administrative changes in office design and support services

(Mazzarol and Soutar, 2001) resulting from exposure to The 5<sup>th</sup> Wave, will create more open-plan office space and open connection/communication suites that reduce overall associated office costs. The resulting outcome indicates that the 5<sup>th</sup> Wave revolution will change all university operations from the classroom to the professor's research hideaway. This raises the notion of the declining university sprawl and the retraction towards smaller universities, with diverse populated university campuses which are not geographically limited, with researchers academically networked and connected.

Further, changes in pedagogic provision will drive m-Learning practices to become the *mainstream* pedagogic engagement. This may seem bold, but as this is driven firstly by cost considerations; it will also be driven by behavioural issues (Earle, 2002) - staff education and training - and more specifically through flexibility needs and on-going demands of students. Thus, social networks related to changing student pedagogic demands will impact on how students interact in their learning arena, not by what the university can provide, but by the residual pedagogic interests initialised. This may be reinforced by students/stakeholders and enhanced through a more social involvement/imperative through staff/student collaborative roles (Collier, 2001) and stipulation, resulting in a more focused pedagogic discourse that is individualised, rather than just providing for group/mass educational needs. Thus, The 5<sup>th</sup> Wave when operationalised by universities will change the focus towards increased service provision for students, and away from staff. Behavioural forces will change the power-mix as students realise that their learning needs become an increasingly important aspect of university life. Consequently, The 5<sup>th</sup> Wave will prompt changes to university operations in terms of

management of staff; quality; examination protocols; and library provision (building). Central administration will be reduced as a focal point as distributed learning systems affects the way universities are set-up resulting in greater consolidation, lower costs and more effective use of learning provision and more towards an invisible espoused service-ethic, as students spend less time on campus and more time in cyberspace. Higher education will possibly get cheaper as more students are able to access pedagogic provision. Pockets of the application of these aspects are already in use today - Phoenix University and Jones International University are such examples, and more will follow. Universities may wait, but may suffer serious financial and reputational - branding concerns (James, 2008f) if universities fail to plan appropriately. Unfortunately, many universities in Thailand have no policy nor an informed strategic intent to engage in cohesive university-wide m-Learning practices.

Could The 5<sup>th</sup> Wave create and enhance a more collaborative visualisation? The proposition appears to have a positive edge. Distributed learning, fully integrated and flexible in university operation, still has to satisfy one essential component though – individual learning needs – and we are all different, and eventually this is where the power of m-Learning will really generate some sophisticated assurance resulting in personalised delivery of identified learning needs (Dikaiakos (2002), as and when students/stakeholders need it. This is the ultimate focus of university pedagogic provision through m-Learning technologies. The university learning what students need, without the technology getting in its way and delivering a cohesive and appropriate pedagogic undertaking. This will be The 5<sup>th</sup> Wave in action.

New forms of m-Learning will certainly be introduced. Thus, managerial changes in the “classroom” result from culpable changes in the pedagogic provision as the technology, as an object, reduces and distributed learning processes and consequent learning focus become the nucleus of university managerial intent. Cyber universities using older models of learner-technology engagement may also be affected as more absorbed contemporary universities using exotic technologies also clamber for the global student resulting in less engaged universities observing their student market share diminish over time. Consequently, student demands could subsequently add pressures to Thai higher education as m-Learning means students are never off-line – they are on-line as long as the battery lasts and provide opportunities for self-expression, connectivity and self-creation (Takahashi, 2008a). However, engaging HE processes to consistently meet students requirements comes at a cost. Besides the usual costs of media development, universities in Thailand will also have to bear the costs of on-going staff training; upgrades to hardware and software; and of course the cost of understanding what students want. Whilst these are upfront costs, which burden the higher education purse, there is also the opportunity-cost associated with not engaging with such contemporary technologies as the competition seizes such opportunities to increase student recruitment and retention (May and Boustead 2003). Thus universities are set to reduce staff (especially direct support staff - Collins, 1996) and increase student numbers through cheaper and more effective provision that affects curricular aims and objectives. This also puts pressures on HE internal changes such as quality assurance mechanisms and how these are changed to facilitate learning assessments. Thus, changing one part of the technological equation creates fundamental and on-going issues that underpin exactly what HE needs to do in order to match

student demands. Web 3.0 and any corresponding use of mobile-devices are seen as technological tools in linking the university to meet these current student demands. The power of Web 3.0 underpins e-Learning 3.0 and helps create and communicate towards a more effective HE distributed learning environment within what is imagined as a mobile-device dominated domain.

## **5.0 The 5<sup>th</sup> Wave - Some Further Issues**

### **5.1 Managerial:**

The four previous waves were driven by technology developments. The 5<sup>th</sup> Wave is driven by the student/stakeholder exploiting changes in socio-cultural learning demands and patterns and the consequent changes in strategic intent of university managers brought on by concerns over impending reductions in student numbers. The 5<sup>th</sup> Wave is not exclusively a technological issue though, and could be seen as more of a managerial issue as it relies on the seamless operation of m-broadband technologies underpinned by WiMax and 3G technologies. Thus, the 5<sup>th</sup> Wave requires the adoption of both WiMax and 3G configurations in order to ensure or at least to provide the possibility of seamless operation and minimum restrictions in terms of coverage, speed and operational performance.

Further, software developments – making it easier for the end-user to integrate, flexibility will not to be enhanced. Presupposing that in the long-run software engineers will be trained and employed directly in universities. Maybe this will provide another employment avenue for those graduating as a software engineer.

Challenges for university management include providing on-going teaching and

research support (Casey & Rakes, 2002;) for increased distributed learning provision; support for increasingly off-campus student provision; staff training and support (Groves et al., 1998) in ICT developments for administrators, faculty and other ancillary staff (Perry, 2003). This will also impact on training as human resources would be required to be more ICT literate in order to communicate effectively with progressive digital natives using more involved ICT tools and processes.

### **5.2 Behavioural:**

Issues surrounding students, ICT support, lecturers, other support staff and university management will include barriers that are not technical or economic, but psychological, organizational, political, and cultural (Dede, 2001). Learners put in and contribute - rather than simply download and interact - this is web 2.0 in action. However, the interactive disposition of The 5<sup>th</sup> Wave will take universities beyond this - the responsibilities will increase and the burden of matching latent demand will also create additional operational pressures.

An additional issue revolves around educational space management (Guri-Rosenblit, 2005). The use of m-Learning will allow university management to diversify their educational provision and offer more effective space management - especially useful for UG programmes that are based on standardised provision to many students. There will be a reduction in the physical distribution of higher specification hardware as a consequence of increased adoption of *cloud-computing* capability through distributed software and adjusted ICT engagement patterns. Paradoxically, through this there could possibly be a more centralised platform for management of the learning environment, through a more effectively distributed m-Learning platform.

Whilst students have the capability of learning anywhere, provision is often becoming more centralised to the ICT resource centre – introducing cloud-computing capability within the annals of the 4<sup>th</sup> Wave – Web 1.2-Web 2.0 and extending this firmly within the application of The 5<sup>th</sup> Wave.

### 5.3 Technical:

Coupled with the technology limitations are the issues surrounding delivery bandwidth (Keegan, 2003) which has an impact on the effectiveness of the whole m-Learning experience (Cunningham et al., 2000) – irrespective of the mobile device capability.

Emerging economies are likely to support the ultra-mobile markets for Cloud Client Computers (CCC) (gigaom.com, 2007) as this will ensure that widespread engagement in cheap and very functional hardware will result in the take-up and the consequent need for e-learning developments. These developments are likely to dominate the concerns of educational technologists and e-Learning providers for the next 2 decades (Ahead in the Clouds, 2008). Therefore the growth of OLPS - one laptop per student - is possible for the more advanced universities who want to help students engage more effectively with their brand of e-Learning provision. This will have a significant effect on student numbers - especially in technology oriented programmes.

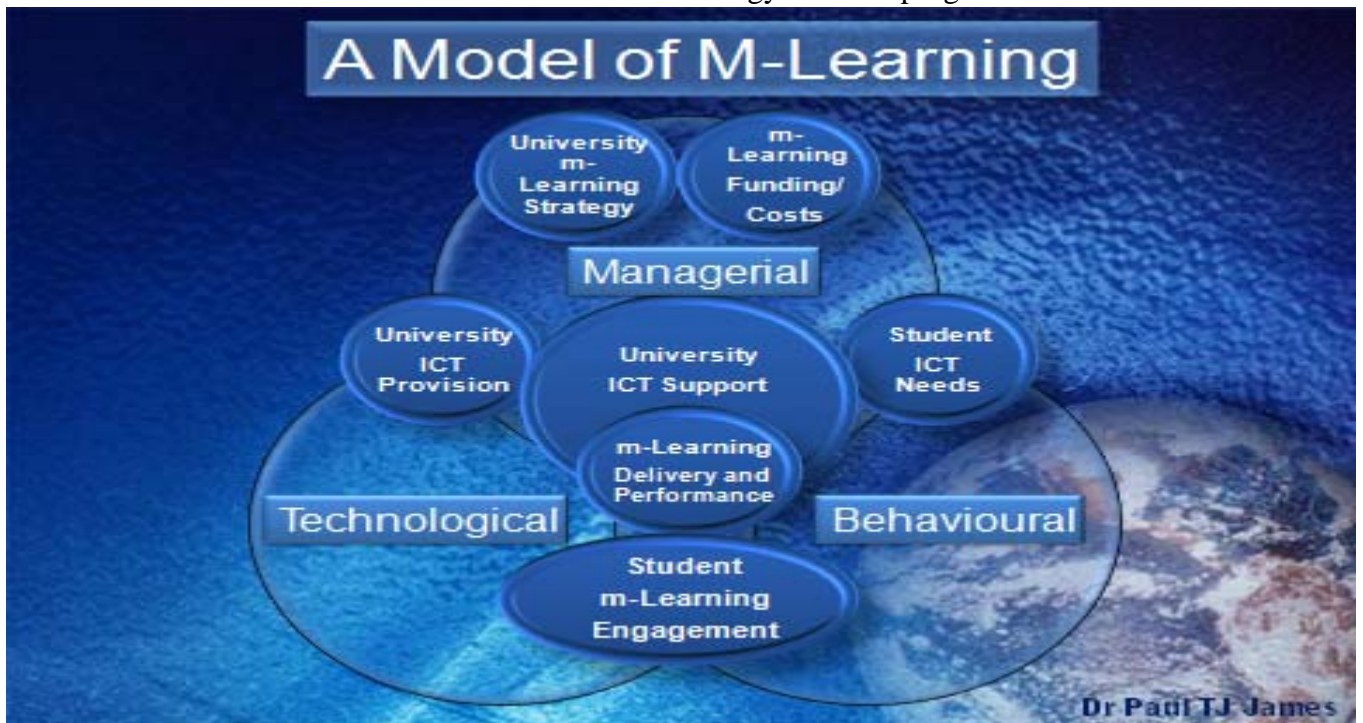


Figure 1

## 6.0 The Application of a Possible Model of m-Learning in Universities Experiencing The 5<sup>th</sup> Wave

Following the discussion on the implications of contemporary m-Learning technology use within The 5<sup>th</sup> Wave, it may be prudent to understand what the possibilities are for future, and an assessment is required of exactly what m-Learning is, and its potential; and how this may contribute to the overall ubiquitous technology development personified through the application of m-Learning in higher education. A possible model, Figure 1, is presented above.

As can be seen from the model, managerial impacts involve an m-Learning strategy, related to funding capability, which drives the university ICT provision that impinges on student needs. Directly linking the technological and behavioural elements is delivery and performance and student m-Learning engagement. These aspects together configure the teaching/learning environments within higher education and illustrate the complexity and challenges given to any future development of m-Learning practices in higher education.

m-Learning will not be an easy feature to introduce and utilise appropriately in higher education in Thailand. However, the promise of the technology and the enthusiastic behavioural disposition of many younger students today will almost certainly create the need for such pedagogic engagement in the near future.

## 7.0 Conclusion

The overall outcome requires that we have an overarching, progressivist m-Learning pedagogy that will:

- accommodate different learner perspectives in developing learning strategies, models and applications;
- support virtual networked and collaborative learning practices;
- help develop university staff – tutorial and support; and
- create a focal point of operation that helps create communication patterns and activities that bridge students/stakeholders and the university towards common pedagogic goals.

The 5<sup>th</sup> Wave when researched, analysed and assessed in due course will almost certainly be seen as an integrating wave that ensures the managerial, behavioural, and technical issues are explored to create a unified pedagogic framework at least for the next two decades of the 21<sup>st</sup> Century.

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Mobile. Is 5G Harmful for Humans and the Environment? Small-cell antennas are about 4 feet tall, with some as large as a refrigerator. "FCC is urging an accelerated deployment schedule for the 5th generation wireless infrastructure, to be installed pervasively throughout the United States. This is being done without public health review of the growing body of scientific evidence that includes reports of increasing rates of cancer and neurological diseases that may be caused by exposure to EMF from wireless sources." "5G networks will also create astonishing and really thrilling new opportunities for our people" opportunities that we've never even thought we had a possibility of looking at." Most students are not prepared for the challenges of university and end up being overwhelmed, which results in them taking extra time to adjust to their new life. That is fine, as long as you eventually get comfortable with university life, but a far better course of action would be to prepare yourself, mentally and emotionally, for any problem you may face at college and university level. Here are a few issues you should be ready to deal with as a university student.

1. Adjustment to New Life. Students should expect the studies to be much harder than before, and at the same time, should focus more on learning rather than getting a good GPA.
4. Cost of Education. Difficulty experienced in engaging learners actively for online learning " This is one of the main factors that determines the success or failure of the eLearning process and hence is key to its implementation and sustainability. Requiring a very high degree of self " motivation online learning becomes a challenge since not many students possess this quality; hence the learners find it difficult to move from traditional to new eLearning modes. Opportunities provided by eLearning. Incorporating mobile learning which will help overcome the issues of connectivity and accessibility to a great extent. Leveraging on the use of the mobile phone, eTutorWorld recommends that mobile technology be used to the highest possible extent.

To address these challenges, we carry out a survey of existing solutions and standards, and propose design guidelines in architectures and protocols for mmWave communications. We also discuss the potential applications of mmWave communications in the 5G network, including the small cell access, the cellular access, and the wireless backhaul. Finally, we discuss relevant open research issues including the new physical layer technology, software-defined network architecture, measurements of network state information, efficient control mechanisms, and heterogeneous networking, which should be for Millimeter-Wave Mobile Communications for 5G: Challenges and Opportunities. Fatimah Al-Ogaili and Raed M. Shubair. Electrical and Computer Engineering Department, Khalifa University, UAE. The forthcoming 5th generation (5G) is considered as an integrative system that combines the already deployed wireless communication systems namely, the LTE and Wi-Fi under a. This article presents a comprehensive review on the feasibility and challenges of millimeter wave in emerging fifth generation (5G) mobile communication. 5G, a multi-gigabit wireless network is the next generation wireless communication network. The mmWave cellular system which operates in the 30-300 GHz band has been proposed for use as the propagation channel. This chapter analyses the opportunities mobile learning presents and the impact mobile devices have had on teaching and learning practices and the barriers and challenges to support competitive educational experiences. Chapter Preview. Top. Introduction. In our "information society" education is taking advantage of computer technology which can enhance and improve the teaching and learning process. The traditional classroom, teacher, textbooks, blackboard can no longer satisfy the needs of generations of students used to handling technological tools from a very young age.