# Draft Proposal for Ph.D. Thesis

*Area of Study*

e-Learning

*Possible Title*

## THE EFFECT OF WEB-BASED ATOMISED E-LEARNING ON ACHIEVEMENT

Submitted to : Prof. E. Bacon and Prof. L. MacKinnon
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By : Andrew Wicks

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## Introduction

(Please go to this web page (using any browser other than Internet Explorer) to see how this introduction might look if it were an atom.)

The standard model of giving out a piece of coursework in September and expecting the students to return it in May does not work. Common sense says that the students will only start the work once they feel confident they can complete it – and for the best students that will only be a few weeks before the hand-in date. Those less diligent either do badly, fail or do not submit at all.

A better system for the coursework is to break it down so that the students have something to show on a regular basis. This has three advantages; first, the work gets completed. Second, the progress of individuals can be monitored more closely and finally, early successes to lead to increased motivation.

This proposal takes this idea one stage further. Here the students would be presented with (and assessed on) one item of learning at a time (an atom of learning). An atom has the following five characteristics:-

1. An atom is a discrete unit of learning.
2. An atom does not have a level since the same atom may be used for qualifications at different levels.
3. If an atom relies on prerequisite knowledge then these should be in separate atoms.
4. Once completed, an atom stays owned for life.
5. An atom should, as far as is practical, be presented in a learning style and ability independent format.

It is then be possible to map atoms to qualifications - and there will be overlaps. For example, an atom on calculating a mean would be appropriate for GCSE mathematics, A'Level Biology and maybe a university course. The atom is neutral to the level. It is the context into which the atom is put that gives it a level.

The fifth point in the list above, learning style and disability independence, is important in several ways. All of us who teach hope to present the materials in the most understandable format, but in reality we do so in the way we work best. Our students may come from other educational experiences have differing abilities/disabilities. The students may become confused through no fault of ours or theirs. Atoms should be presented in several ways, as text, videos or MP3s, for example then the student is not bound to follow our way. The site should allow the font size and background colour to be altered to help those with sight or dyslexia difficulties. If lots of people produce lots of atoms then the student would have the opportunity to use an atom which explains the topic in their preferred way. This would be open learning.

A further distinction to be made is that the physical implementation of an atom is called an aPage (an abbreviation of atomic page). Whilst this could be on paper, a web page would be more appropriate since it would allow hyperlinking to the various learning media. The intention is to have two inter-linked websites; one to allow people to create and consume atoms and the other to handle the administrative side. This would make separating the two functions easier and more logical. These sites are www.o-vl.com (O-VL) and www.edulevel.com respectively.

O-VL (short for Open Virtual Learning) will allow anyone to create aPages which will add a breadth of learning experience for all. Apart from the links to text, video and MP3, an aPage would also have a self-assessment quiz and allow coursework to be submitted for the material covered, thus linking process and product for the student.

The students on an atomised curriculum will need monitoring and this is where their lecturers or teachers will use EduLevel. This site will allow staff to set up a course, mark submitted atoms and monitor the progress of their students from their own on-line virtual office. The students will also have a virtual office in which they can monitor their progress and set goals. Verifiers and inspectors will also have virtual offices in which they can view student work and feedback.

EduLevel will also contain a virtual Common Room to which everyone would have access. Here summary statistics will appear, but only if there is a sufficient quantity of data that ensures no individual or individual institution can be identified.

Whilst both sites will share a common database, the educational and administrative functions will be separated.

This system will mean that students can progress at a pace with which they are comfortable. Student progress would not be tied to a scheme of work, but to their level of motivation and monitoring. An increased speed of feedback and the small nature of the tasks involved could be expected to increase achievement.

Portions of this have been trialled and the results for these were positive. Now it would be nice to provide the academic justification for atomisation.

## Problem Statements

There are many different teaching strategies employed in the British educational system. These are typified by schools such as Bales[1], who pride themselves on their liberal approach at one end, whilst others, such as Eton[2], have a more traditional approach. This spectrum of approaches looks at discipline as the barometer of achievement rather than individual attainment. Both achieve excellent results, but they each have their failures too. Individual learning styles will be more suited to one system or the other, therefore an individual may flourish more in one situation rather than another.

Rather than fit the person to system, maybe an alternative approach would be to fit the system to the individual. For example, tertiary education works according to a fixed scheme of work. All the students taking a course will cover the same material at the same time. The pace of the course is static. The individual either fits that pace or fails – regardless of circumstances, preferred learning styles or speed of internalisation. One has to wonder how many more might succeed if a system which maintained academic rigour was more adaptable. Is it possible to devise a method which would be suitable for all levels and abilities?

[1] http://www.balescollege.co.uk/
[2] http://www.etoncollege.com/

## Research Questions

Atomisation would complement rather than replace current teaching practices. It would, as Salman Khan[3] says, invert the teaching methodology. Instead of teaching followed by homework, the model then becomes homework in which the atom is attempted followed by the class in which the questions of individuals are answered and the atoms completed and signed off.

The benefit of this could be assessed by answering the following questions:-

a) Does atomisation increase the quantity of learning in terms of:-
    i. The number of atoms completed.
    ii. The number of people passing the qualification.
b) Does atomisation increase the quality of learning in terms of:-
    i. Exam success rates.
    ii. Coursework completion rates.
    iii. The retention rate of students.
    iv. The progression rate of students.
c) Are alternative learning styles covered?
    i. Examination of learning styles literature
    ii. Student feedback.
    iii. Staff feedback.
d) Is there an increase in perceived value in terms of:-
    i. End of year student satisfaction survey.
    ii. Staff feedback.

[3] http://www.youtube.com/watch?v=gM95HHI4gLk - TED 2011

## Research Objectives

The main objective of this study is to examine the impact of atomisation on the achievement of students. In doing so this study will seek:-

a) to investigate the qualitative and quantitative impact of atomisation.

b) to assess the impact on the staff involved with atomisation by examining any changes in workload and teaching patterns.

c) to create a strategy for the production of the learn materials.

d) to create a strategy for the production of an atom map of education at different levels.

e) to develop an administrative system to deal with atomisation for staff, students and moderators.

## Significance of the Study

This research will add to the knowledge of alternative teaching strategies, thus possibly opening up new avenues for academic achievement. Over time this could have a positive impact on the economy (through greater productivity), society (by spreading meritocracy more broadly) and the individual (via increased self-actualisation caused by lifelong learning). There are five significant areas:-

a) The study would provide the road map to allow schools, colleges, universities and businesses to develop bespoke courses by stringing together existing atoms. These could then be made available at little cost.

b) Individuals would be able to continue their education in both a formal and informal setting. For example, general knowledge acquired through curiosity could be accredited as well as more formal qualifications.

c) Individuals and institutions could capture dying knowledge by creating atoms. For example, a harp restorer may decide that the skills acquired over a life time could be passed on in the form of atoms.

d) People in all countries could benefit from on-line materials which provide access to knowledge. UNICEF estimates[4] that 101 million children do not have access to any education at all. On top of that, are likely to be many times that figure who get a bare minimum. Access to cheap computers, such as the Raspberry Pi, alongside a range of free on-line learning materials could have a positive impact. Those who consume these atoms may then decide to translate them into their own language thus making education even more accessible.

e) There is no science of pedometrics[5] yet in the same way that there is for, say, economics. In part this is due to the granularity of the data. Success in education is only measured in the number of qualifications achieved.

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[4] http://www.unicef.org/education/index_access.html
[5] The mathematical study of education.

However, education itself is about far more than that. If the statistics were broken down to the level of atoms then there would be scope for a more mathematically formal treatment of education. New ways of understanding the learning process could be developed. That in turn could lead to a much more educated society.

## Scope of the Study

At the forefront of this research would have to be whether the approach was ethical. It would be morally unjustifiable to advantage one group over another. This might come about if, say, a course was split into two groups, one with access to atoms and the other not. This would also be impractical since all the materials would be openly available on the Internet.

The study could be based on those taking the Introduction to Programming course at the University of Greenwich and/or and its equivalent for those taking the BTEC National Diploma in IT at Lewisham College, thus covering post-16 education.

It may also be possible to enlist a primary and secondary school if suitable teachers could be found. These might volunteer if the idea is put forward in an article in one or more of the newspapers/journals aimed at these groups.

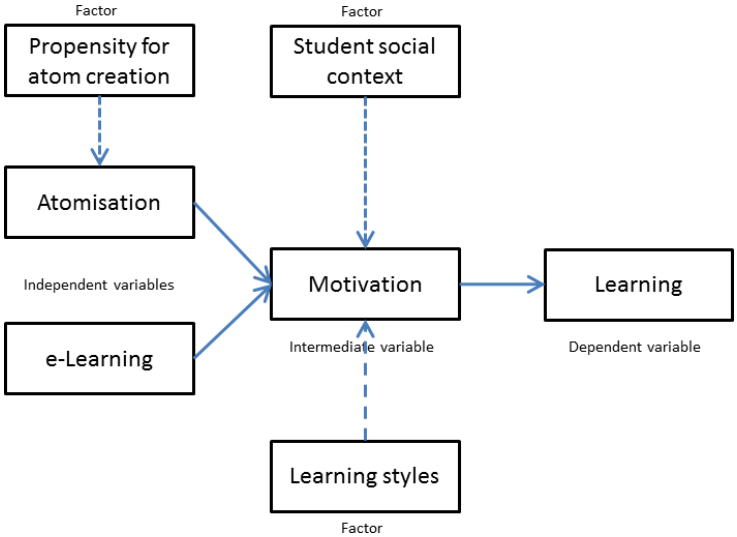
## Theoretical Framework of the Study

The objective of the study has two prongs. The first prong would be to assess whether atomisation has a positive effect on learning and the second to develop the infrastructure which would allow its implementation - if it were found to help.

The current technology in this area is the Reusable Learning Object(Policy et al., 1967). There is an IEEE standard (Hodgins and et al, 2002) which seems not to have been taken up despite its obvious advantages. No commercially available virtual learning environments support them(Cook et al., 2006). These RLOs are viewed from a programming point of view rather than that of the student. This proposal would aim to create an alternative open standard aimed at the needs of the student.

There is some debate over the effectiveness of e-learning (Liaw, 2007) in varying situations. The effect of learning styles (Kazimoglu et al., 2011) on the usefulness of specific e-learning environments has been studied, but generalised conclusions have not been reached. An alternative approach would be to provide that materials in a variety of formats, making individual learning preferences less critical.

The diagram below summarises this approach. The critical item is the quantity and quality of learning produced by this system and that will depend upon the level of motivation of the student. This motivation will depend upon both the social context of the student (their need for this course, their home life, their social life, etc.) and their preferred leaning style.



## Definition of Variables

The variables in this study would be:-

1. The quantity of atoms available
    - Time
    - The willingness of people (staff, students and externals) to create atoms
    - The availability of atom creation/consumption software
2. The social context of the students
    - Their propensity for study
    - Their financial status
    - Their personal wellbeing
    - The length of their life horizon
3. The preferred learning styles exhibited by the students
    - Their willingness to engage with e-learning (a learning style of its own?)
    - Internal/external learners and serialist/holist learners(Pask and Scott, 1972)
    - Their VAK/VARK preferences(Institute for Learning Styles Research, 2013)
    - Their Activist, Reflector, Theorist and Pragmatist preferences(Honey, 2001)

# Research Methodology

## Introduction

The methodology list used below came from the University of Huddersfield website (University of Huddersfield, 2013).

## Inappropriate Methodologies

There are methodologies which are not appropriate to this area of research, being more suited to either the physical sciences, social sciences or the arts:-

- Analytic Induction
- Biographical Research
- Case Study Method
- Constructionism
- Conversation Analysis
- Discourse Analysis
- Ethnography
- Ethnomethodology
- Field Research
- Frame Analysis
- Grounded Theory
- Hermeneutics
- Interpretive Phenomenological Analysis
- Life History
- Matrix Analysis/Logical Analysis
- Memory Work
- Narrative Analysis
- Objective Hermeneutics
- Phenomenology
- Qualitative Comparative Analysis
- Symbolic Interactionism
- Template Analysis

## Possible Methodologies

**Action Research** : This is an iterative process in which the hypothesis is refined after each stage of the study. This form of research would be appropriate to the start of this project when the format of an aPage and the offices are being refined.

**e-Research** : This form of research uses digital technologies to gather data and allow a range of people to collaborate its interpretation in both a formal and informal way. This is likely to be the principle tool used during this project since all the quantitative data will come from student interaction with the websites.

**Framework Analysis** : This approach uses a hierarchical thematic framework in which a list of themes and sub-themes are developed. Each case is then sorted into its own row and column and then examined for patterns and connections. This form of research may be appropriate to this study when analysing the results of a specific and small sub-group. For example this would appropriate when looking at those who complete multiple atoms in one sitting.

**Phenomenography** : Developed at the University of Gothenburg, it is used in educational research to examine the development of learner understanding. Whilst this is a qualitative research methodology, it will be particularly useful when assessing the effect of atomisation and the websites on the student results. There will be a need to compare the perceived value to students to the actual outcomes.

## Literature Review

e-Learning is still in its infancy. Whilst its origins are disputed (Özgün et al., 2013)(Zwiauer, 2003)(Nicholson, 2007) it is fair to say that they go back to near the start of digital computing. A "newcomer" to the arena is m-Learning (mobile learning) which claims its origins in the pre-digital era with things such as Lingaphone on cassettes (Wikipedia, 2013). However, for the purposes of this study, only the current digital media such as mobile telephones, MP3 players, etc. will be considered. The computing and mobile technologies will be aggregated as if they are one since the websites will work on both, giving me-Learning.

me-Learning has two components; the hardware (plus the operating system) and the software (the websites). The hardware is currently dominated by computers but mobile devices are starting to eat into this market with their share going up by nearly 50% in the past year (W3C, 2013)(Meeker, 2012, slide 10). The largest growth rate for Internet usage since 2000 is in Africa (3,607%) and the Middle East (2,640%) with Europe logging 393% (Internet World Stats, 2013). The future take up of the Internet looks healthy and with that, me-Learning can be expected to grow too.

However, there is little agreement on a standard for me-Learning materials. The larger VLEs (such as WebCT, Moodle and the late Bodington) use SCORM (Rustici Software, 2013). Other systems, such as those developed by the University of Cambridge, the University of Nottingham and London Metropolitan University use the standard set by IEEE (Hodgins and et al, 2002) for reusable learning objects (Cook et al., 2006). The latest initiative in Higher Education, the MOOCs, will presumably each have their own closed standards. However, this top-down approach to content creation does not reflect the spread of knowledge. Two relevant examples of potential alternative content sources might be occupational specialists and those with an academic background who are also fluent in another language. Education should have room for all of this material.

Another facet of this top-down approach is the assumption that academics produce materials. This ignores the learning style preferences of students. Some work has been done on matching learning styles to preferred learning environments (Peter et

al., 2008-11-17). However, this approach has two problems; first the computer is adapting the materials presented rather than allowing the user to choose and second the materials are still presented in a particular way which may not match the student preference for that type of material.

There appears to have been little, if any, research on the way content is presented in a VLE, let alone tying this to learning styles. An objective would be to create a system which was as learning style independent as possible. In other words, the student would choose the route, the speed of working, the style of materials presented (text, sound or visual) and be able to submit work all where the materials are presented (Wicks, 2011).

## Outline Timetable

**Orientation and basic research** (Year 1)

- Complete the orientation materials on-line
- Refine this project proposal
- Develop a wider range of sources
- Add database connectivity and hard-coded atoms to O-VL (say, for the Introduction to Programming course, COMP1148).

**Literature search and site development** (Year 2)

- Create the outline for the dissertation.
- Hone the literature review in line with the outcome of the improved proposal.
- Write the code to enable others to create atoms to be used on O-VL.
- Write the code to enable the administration of courses and the recording of student progress on EduLevel.

**Surveys and analyses of results** (Year 3)

- Gather user feedback (staff and students) on using the preliminary websites.
- Gather retention and achievement data to analyse the effectiveness of atomisation by comparing the results of courses taught using atomisation with those that did not statistically.

**Detailed product development** (Year 4)

- Amend the websites in line with finding of the year 3 results.
- Gather more data on retention and achievement.

**Re-evaluation and writing up the dissertation** (Year 5)

- Review the statistics gathered after the site was redeveloped and compare them with the ones from before statistically.
- Write up the research.

Note: Even I am not that naïve as to believe that everything will go to plan, therefore a sixth year might be needed as the schedule above slips due to unexpected hiccups.

## Potential Post-Doctorial Research

One of the problems faced by researchers in e-Learning is the course granularity of the data. Statistics only show how many got each grade, they do not show learning. As a lecturer at Lewisham College (now LESOCO), I was reminded of this each time we held interviews. The GCSE results were such a poor predictor of actual ability that we had to use our own set of tests[6].

If atomisation were adopted, the granularity of the data would be far finer, allowing a mathematical framework for the treatment of the educational system to be created, pedometrics. The potential would be there for this science could do for education what econometrics has done for economics. New theories of learning could be tested against the anonomised data, changing educational understanding and through that, policy.

The other main advantage of atomisation from this point of view would be the ability to ensure cheap, high quality education for all, panpedia. This would mean that anyone with an Internet connection would be able to access atoms. Those in hospital or off sick could still complete their education. Those whose personal situation is poor would have an escape route. Those in countries where the educational system does not reach them would have a new option. Education changes lives for the better.

The blog has more detail on these two concepts.

[6] On one occasion I found myself between two applicants. One had an A for GCSE English and the other an E. The student with the A wrote a very poor piece, but the punctuation was excellent. The other wrote a clear and logical response which could be read from beginning to end as long as one could imagine the full stops and commas in the correct place. We took both. The one with the A in English (and other subjects) did not pass. The one with the E got help with grammar, progressed to a computing course at this University and graduated with a First.

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## Appendix A – Blog List

| Title | WordPress Address |
|---|---|
| The Problem | http://andywicksblog.wordpress.com/2012/05/07/the-problem/ |
| The Vision | http://andywicksblog.wordpress.com/2012/05/07/the-vision/ |
| The Nature of a Real VLE | http://andywicksblog.wordpress.com/2012/05/07/the-nature-of-a-real-vle/ |
| Lesson Plans and Schemes of Work | http://andywicksblog.wordpress.com/2012/05/07/lesson-plans-and-schemes-of-work/ |
| The Format of a Schedule | http://andywicksblog.wordpress.com/2012/05/07/the-format-of-a-schedule/ |
| Learning, Knowledge and Education | http://andywicksblog.wordpress.com/2012/05/07/learning-knowledge-and-education/ |
| Why the Failing Sub-Culture? | http://andywicksblog.wordpress.com/2012/05/07/why-the-failing-sub-culture/ |
| So, what is the answer? | http://andywicksblog.wordpress.com/2012/05/07/so-what-is-the-answer/ |
| The Sweetshop Principle | http://andywicksblog.wordpress.com/2012/05/07/the-sweetshop-principle/ |
| Let's go on a journey | http://andywicksblog.wordpress.com/2012/05/07/lets-go-on-a-journey/ |
| Getting Organised | http://andywicksblog.wordpress.com/2012/05/07/getting-organised/ |
| Where are my atoms? | http://andywicksblog.wordpress.com/2012/05/07/where-are-my-atoms/ |
| Now to business - The Coursework | http://andywicksblog.wordpress.com/2012/05/07/ok-now-to-business-the-assignment/ |
| Submitting the Work | http://andywicksblog.wordpress.com/2012/05/07/submitting-the-work/ |

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|---|---|
| Oh, Those Videos ... | http://andywicksblog.wordpress.com/2012/05/07/oh-those-videos/ |
| Tying it all together | http://andywicksblog.wordpress.com/2012/05/07/tying-it-all-together/ |
| Making it all available | http://andywicksblog.wordpress.com/2012/05/07/making-it-all-available/ |
| Getting Google to Organise the Work | http://andywicksblog.wordpress.com/2012/05/07/getting-google-to-organise-the-work/ |
| Getting the Students Organised | http://andywicksblog.wordpress.com/2012/05/07/getting-the-students-organised/ |
| What happens in the classroom | http://andywicksblog.wordpress.com/2012/05/07/what-happens-in-the-classroom/ |
| Recording Success | http://andywicksblog.wordpress.com/2012/05/07/recording-success/ |
| Fringe Benefits | http://andywicksblog.wordpress.com/2012/05/07/fringe-benefits/ |
| What makes a good student? | http://andywicksblog.wordpress.com/2012/05/07/what-makes-a-good-student/ |
| A Video Day Out in Dorset | http://andywicksblog.wordpress.com/2012/05/07/a-video-day-out-in-dorset/ |
| Panpedia, Pedometrics and the Golden Cauldron | http://andywicksblog.wordpress.com/2012/05/07/panpedia-pedometrics-and-the-golden-cauldron/ |
| What makes a good course? | http://andywicksblog.wordpress.com/2012/05/07/what-makes-a-good-course/ |
| Attendance Is King - Long Live the King | http://andywicksblog.wordpress.com/2012/05/07/attendance-i-king-long-live-the-king/ |
| What makes a good teacher? | http://andywicksblog.wordpress.com/2012/05/07/what-make-a-good-teacher/ |
| Atomisation Quantified | http://andywicksblog.wordpress.com/2012/05/07/atomisation-quantified/ |
| On Intelligence and Genius | http://andywicksblog.wordpress.com/2012/05/07/on-intelligence-and-genius/ |
| Practical Inspiration | http://andywicksblog.wordpress.com/2012/05/07/practical-inspiration/ |

| | |
|---|---|
| Inspiring Inspiration | http://andywicksblog.wordpress.com/2012/08/18/inspiring-inspiration/ |
| You can lead a horse to water … | http://andywicksblog.wordpress.com/2012/11/16/you-can-lead-a-horse-to-water/ |
| The Nice Pen Principle | http://andywicksblog.wordpress.com/2012/12/15/the-nice-pen-principle/ |
| Replacing OfSTED | http://andywicksblog.wordpress.com/2013/01/04/replacing-ofsted-clock-inspections/ |
| Completed and Certified | http://andywicksblog.wordpress.com/2013/05/05/completed-and-certified/ |
| Atoms and Qualifications | http://andywicksblog.wordpress.com/2013/05/05/atoms-and-qualifications/ |
| Learning Styles (plus External vs Internal Learners) | http://andywicksblog.wordpress.com/2013/05/06/learning-styles-plus-external-vs-internal-learners/ |
| The Bayeux Language | http://andywicksblog.wordpress.com/2013/05/15/the-bayeux-language/ |
| me-Learning: The Bright Future of Learning | http://andywicksblog.wordpress.com/2013/05/20/me-learning-the-bright-future-of-learning/ |