

CHAPTER 1

LEARNING IN THE UNIVERSITY

In this chapter you will learn about

- ❖ How different is university life from life in your junior college or high school.
- ❖ How to cope in the first month of your undergraduate stint.
- ❖ What is higher learning, what are its demands, and how to prepare for it.
- ❖ What adjustments you need to make, and the new skills you need to acquire.

1.1 Welcome To NUS

Your entry into the university marks the beginning of a new milestone in your life. You are about to venture into possibly the most academically exciting and fulfilling experience. But like most things, the beginning is tough. Depending on the background of our freshmen (the masculine gender form is adopted here for brevity), the novelty of things around them will affect the individuals to different extents. Especially so for international students, who have to face problems arising from culture differences, palate preferences, changes in the system and environment, apart from having to gear up for tertiary learning like everyone else.

These changes could amuse, or confuse the freshmen. Some anticipated and greeted these challenges with confidence, while some were plagued with apprehension. Some sailed along well after clearing the initial hurdles, but some were overwhelmed from the start and continued to struggle to stay on course.

Psychologists use the term *life change units* (LCUs) to quantify the impact of personal events on an individual's life [1]. Events with high LCUs either call for a drastic change in the person's habitual behaviour, or put the person in a new or unfamiliar environment. Some examples include getting married, changing job, going into retirement, or shifting house. It is known that the more LCUs an event is tagged with, the greater the stress it could bring about. Hence, the expert's advice is to avoid scheduling too many drastic changes all at one time, if circumstances permit.

For you as a freshman, adapting to and coping with university life is itself a daunting task. If you are an international student, you have even more stuffs on hand to deal with in the first couple of weeks. All these come to you at about the same time, and there is no escape – you just have to face them squarely.

Ignorance is no bliss. Problems do not just go away because you are unaware of them. Dodging the issues is also non-constructive. The key to handling inevitable changes is preparedness. Before you could prepare for anything, you need to know what lies ahead. The rest of this chapter highlights the various potential obstacles you are about to encounter. By creating such awareness, we hope that you would then be able to foresee what are in store for you, and arm yourself with appropriate strategies to tackle the impending challenges.

The purpose of presenting all these horror stories is not to intimidate you, but rather, to forewarn you. We are here not to paint a gloomy picture and drum fear and panic into anyone. Instead, we ask that you summon up your confidence and resolute in meeting the challenges you will face in the first weeks of your stay, to settle down quickly to ensure a smooth cruise for the rest of the voyage.

... except for marathons, where the last mile is always tougher than the first.

Yes, even changes of a positive nature, like striking the lottery, can induce stress!

The *APT* strategy:

- ♦ Aware
- ♦ Prepare
- ♦ Tackle

A good start is half the battle won.

1.2 Handy Tips For New Students

Nobody did it better than the staff at the CDTL (Centre for Development of Teaching and Learning) when it comes to penning and compiling a comprehensive guide for the freshmen. You are strongly urged to read their publication “The Effective Student – A Guide to Learning for the NUS Student” [2], which is distributed to all new students. An on-line version is available at this web site

<http://www.cdtl.nus.edu.sg/ufm/>

Go read “The Effective Student”.
— by order.

This guide provides essential pointers to the new kids on the block on coping with many aspects of university life. Covering topics ranging from how to adjust your mindset and how to adapt to the new environment, to the importance of the various skills on learning, time management, and stress management, just to name a few, this indispensable guide is indeed a pleasant gift. You are urged to read this guide.

There is hence little need for this book to repeat the points covered in the guide. Nevertheless, just as the guide focuses on the NUS setting, I shall attempt to address issues more pertinent to the School of Computing, or go through some important points that deserve a second look.

1.3 Some Words Of Advice For International Students

International students have a much bigger share of load to shoulder. Additional stress comes from being away from home, and the pressure to fulfil their obligation towards family and for some, the scholarship provider. Most international students stay in campus hostels, and have to juggle their time between study and the host of hall activities they have to undertake. These could be distracting and energy draining.

It would be deceiving and irresponsible of us to paint a rosy picture that all students managed to cope well. Some did not, so their academic performance dipped and they got frustrated and demoralised, and their performance degraded further, and it became a vicious circle.

There is no easy solution. Being vigilant is one way to safeguard against such slip. Equally important is to learn to come to terms with failure or setback when it happens. This is even more so if it is due to faults not of your own. You must also learn to be resilient and never to wallow in grief. Reassess your position and devise a remedial plan.

You can also ask seniors from your country for personal problems. I feel more comfortable with that. ☺
- a senior

The above advice could well apply to local students too, only that international students need it more because they are likely to feel more helpless as they are away from home, away from their pillars of support.

Just remember that if you ever feel overwhelmed, seek help. As freshmen, your limited immediate contacts are your course lecturers and tutors. Seek help from them. They will be most willing to listen, and if necessary, direct you to the most appropriate persons who can render you the help you need.

1.4 Different Strokes For Different Folks

As you leaf through the pages in this chapter, you may find some anecdotes that strike a chord in you, some that seem mystifying, while some that might just elicit a good laugh from you. This is expected, since we need to cater to a multitude of readers, each bringing along with him his own bag of experiences and expectations. So, what applies to Kim might not matter to Sam. What seems to be a breeze to you might be a real stumbling block to your course-mate.

Even if you find that you are perfectly at ease with the new environment (congratulations!), knowing what are the potential pitfalls does you no harm. At least it could serve as a gentle reminder. It might even make you a more compassionate person who can empathise more with your fellow course-mates who fell. In that case, give your friends a hand to help them pull through. They will find warmth in your support and encouragement.

Finally, bear in mind that this is no panacea, and the treatment here is by no means complete. If there are blind spots, please do leave us a note.

1.5 Learning At Tertiary Level

What makes learning so special in the university that it warrants the preparation of a student guide just to help our students to make the transition?

From past experiences, we have witnessed too many freshmen being hit by the culture shock they came to meet and the series of revelations they soon uncovered in their first weeks of campus life. Some regained their composure and adapted quickly, others remained dazed for a while, hopefully not for too long. If we skip the non-academic aspects that are well documented in “The Effective Student” guide, one particular academic aspect that stunned the freshmen most is the discovery that learning suddenly becomes so different and strange in the university.

Spare me a moment to share with you my personal experience. My first undergraduate lecture was an algebra lesson on integers. As the lecturer began scribbling on the blackboard, I thought to myself: “I have been studying algebra all these years, haven’t I? And I am pretty sure I know what integers are. So what am I doing here?” But at the end of the hour, when the lecturer finally put down his chalk and walked out of the lecture theatre, I was dumbfounded. “What is this? This is not the mathematics as I have come to know. What proofs? What Peano’s axioms? Where are the examples?”

We call this level of learning “higher education”. To reap the most out of it, a shift in learning mode is required of the learners. Depending on your background, some of the following scenarios may spell anxiety or agony for you.

*“More examples!”
Hear the perennial
cry of our
undergraduates.*

Computer scientists count in bits - 0 and 1 - and have only two fingers. So, anything more than two is just too much.

- ❖ “*Where are the examples?*” Lecturers are horrifyingly stingy with examples. Unlike your college teachers who churn out examples after examples to illustrate a single concept, method or theory, you should be content with one example, or occasionally two. If you get a dosage of three, mark down that special date – it could be your lecturer’s birthday.
- ❖ “*What is a tutorial class?*” If you are an international student, the lecture-cum-tutorial system may be new to you. You do not get to stick to the same class all the time now; you are assigned to different tutorial groups for different modules.
- ❖ “*Where are the 10-years series?*” For the uninitiated – in this case, you may skip this paragraph – 10-years series are compilations of solved problems of past years’ examination papers, a well sought-after commodity by college students aiming to score really well in their ‘A’-level examinations. Students are not encouraged to attempt to get by on such rote-learning strategy. Read on to the next point.
- ❖ “*Why do the syllabus and the format of the examination paper seem to be different from previous year’s?*” Because it is taught by a different lecturer! When another lecturer takes over a module – and this is rather common here as in many universities around the world – he gets to decide on how to teach the course, which textbooks to adopt, and what questions to set, among other things.
- ❖ “*Why is the pace so fast? Why is the workload so heavy?*” Actually, it is a matter of perception.

Time seems to tick by more swiftly on hectic days. As you are caught up with the host of activities, your attention is divided, and your energy is depleted quickly. A bout of anxiety may further erode your efficiency. A tired body tends to feel slow relative to the rustle and bustle going around it.

On top of this, spoon-feeding and handholding are no longer practised. Independent learning becomes the order of the day, so you need to devote more time now than ever to look up information yourself, instead of relying on your lecturers and tutors to fill you in.

Trust me, it is!
- a senior

Actually, as far as academic workload is concerned, the first year is often dubbed the ‘honey-moon’ year. (Now you may not believe it, but in retrospection you will.) This is a blessing since our freshmen need more breathers. Your seniors will tell you that the pace will pick up in no time, after the ‘honey-moon’ period. So, brace yourself for even more punishing pace and heavier workload to come. However, do not despair as by then, you should be a seasoned learner, breathing in sync with the beat of things.

- ❖ “*Why don’t the lecturers teach the hottest topics in town? Why do they assume that we know the ‘this and that’s’? Why do we always have to pick up the ‘this and that’s’ ourselves?*” As these questions touch on a rather heavy subject, a separate section would do more justice.

1.6 Balancing The Act

Computing, in its broadest sense, encompasses a whole spectrum of topics related to computers and applications involving computers. The School of Computing offers different degree programmes – refer to the website <http://www.comp.nus.edu.sg/undergradprog/> for details – each of which leads to its own areas of specialisation. Apart from these, the School also offers joint programmes with other faculties. We shall use the general term ‘computer specialists’ to loosely refer to our graduates who might end up in just any of the myriad professions, holding titles such as computer scientists, information technologists, systems analysts, software engineers, computer engineers, and a host of other labels.

Diversified these branches of computing may be, they share some common grounds. It is generally agreed that there is a set of ‘core’ topics that make up the fundamental concepts upon which higher knowledge is built, and which every computer specialist should acquire, regardless of his area of expertise. The *Computing Curricula 2001* [3] report identifies and categorises these essential topics.

Naturally, such groundwork should be laid in the early months. The basis emphasises on the science, rather than technology. Unlike the technological innovations which are moving at dazzling speed, the fundamentals of the science of computing change much more slowly. The latest fads are usually fanciful and attention grabbing, hence one is readily drawn to them and would even consider the association to be a hip thing. The basics, on the other hand, comprise mainly classical theories and principles, which are seen by some as boring. The important point here is, one comes and goes, but the other is long lasting.

This answers the question why not every latest craze in town finds its place in the computing syllabus. It is a question of priority and usefulness. Firstly, developments are just too rapid and numerous in the field of computing. What is fashionable in your first year might become obsolete well before you graduate. Secondly, some of the new products in the market are adaptations, extensions or combinations of old ideas, usually packaged with a glamorous facade. Thirdly, to understand some of these latest innovations, you first need to have a good grasp of their underlying principles.

It is therefore necessary to lay the foundation firmly first, just as in any other discipline. This is not to deny the importance of keeping up with the latest developments. A computer specialist who does not keep up with time will cease to keep his job too. However, a strong foundation does help one to stay abreast of new developments more effectively. Why is that so?

In the foundation modules, basic concepts of the core topics are introduced, models presented, and abstraction skill imparted. These go a long way towards progressive learning by serving the following objectives.

Buzz is secondary
to content.

Distinguishing between principles and products, methods and tools.

Let me cite the programming module as our case here. Many debates have gone into arguing which is the best first programming language in an undergraduate curriculum in computing. Major issues raised include the ease of learning a particular language, the industrial relevance, and the pedagogical values. Other considerations like the availability of good texts and teaching resources hold a part in the discussion too. However, the bottom line is not so much about the language per se, but rather, it is really about the principles and mechanism of programming. CS1101, CS1101C or CS1101S module should not be a course just about learning the syntax of Java, C or Scheme. Instead, the chosen language merely acts as a vehicle to illustrate essential problem solving techniques and good programming methodology and practice, which are largely independent of the language.

When you enrol in a driving class, your purpose is to learn the mechanism of driving. Whether it is a Honda or a Volkswagen that the driving school provides, as long as they belong to the same class of vehicle in terms of engine capacity or other measures, is quite immaterial. It is unfathomable that you must re-learn driving from scratch whenever you change your car. The basic techniques remain the same, so are the traffic rules. Even if your new car has an automatic gear instead of the manual one which you are accustomed to, or you have been relocated to another city where the driver seat is on the other side of the car, all you might need, if at all, are some quick conversion lessons.

Such belief underpins the expectation that students should not find switching over to another language that belongs to the same class¹ a big hassle. Like driving, all that you need is a comparison table, perhaps throw in a list of new features as well. Sometimes, a few quick sessions may be given. At other times, you are to figure it out yourself.

We come to address a common complaint made by students that they are often expected to pick up new languages (or for that matter, new ‘this and that’ in general) on their own. A typical computing undergraduate can easily count over a dozen programming languages that he has learned and used during his three years of stay, and most of these were done through the DIY (do-it-yourself) way. To ease such self-learning, you must be mindful of the underlying principles while learning the various tools that share and exemplify these principles.

However, reality is further from the truth. Many students do find such demand on self-learning a source of anxiety, or even plain frustration. This stems from their failure to detect the common basis. They were too engrossed in learning the features of the language, losing the perspective that the main objective is to learn the essence of programming. Consequently, a new language is seen as a whole new book altogether, but in fact, it could be treated as just an add-on section.

As budding computing professionals, you need more than a “passing interest” in the craft of programming. Engineers can be allowed to have a passing interest in painting, but not an aspiring painter.

- A/P Leong H.W.

This is easier said than done.

¹ Programming languages are categorised into different classes. Pascal, C, and Ada belong to the class of procedural languages, while Java and C++ belong to the class of object-oriented languages. Other classes include functional languages, imperative languages, and logic programming.

Applying abstraction skill.

In abstraction, we derive models that retain the essential properties of the subject under study, discarding the unimportant details in the process. Theories and methods are then formalised based on these models.

In applying abstraction skill in problem solving, we map the problem to an appropriate model, where we can then employ the proven theorems and well-tested techniques associated with the model to solve the problem. For example, to find the best route from one city to another, we could convert the problem into a graph problem, whereby graph theory and well-established methods could be applied.

In the programming context, abstraction refers to separating the issue of what operations are to be provided from the issue of how these operations are to be implemented.

If the idea in the foregoing discussion on distinguishing between methods and tools is akin to seeing beneath the surface for the fundamentals, then abstraction could be taken as a process of seeing beyond the elaborate details.

These two skills are instrumental in the organisation of knowledge. Learning is like solving a big jigsaw puzzle (see Article 1-1 at the end of the chapter), which involves spotting similarities and discerning differences while examining the bits and pieces of information one gathers. For a fast-moving field like computing where one has to catch up continually with new ideas and developments, these skills are essential for lifelong independent learning.

Knowing the theoretical basis.

Some students complained that the fundamentals are too theoretical. Theories form the cornerstone of any science, and computing is no exception. In fact, even in the arena of arts, theories abound. A reputable musician cannot forgo music theory.

Being a budding professional, you must acquire certain qualities that set you apart from the rest, to earn yourself the respect. A layman playing the Rubik's cube² simply treats it as a toy, but a serious mathematician will tell you that behind the puzzle are lessons on group theory, topology, permutation theory, and more. A programmer will talk about God's algorithm, and a computer scientist will probably view the cube as a finite-state machine whose language is a string of moves.

Computer specialists must be able to translate problems into abstract models. These models are described formally, using special notations and rigorous reasoning. A computer specialist must be able to use these formal methods in his work, and communicate in a scientific and rigorous manner to prove that his solution works. Computing is an applied science, but its theoretical foundation cannot be over-emphasised.



Abstraction is a very important concept.

² Rubik's cube was invented in 1975 by Ernő Rubik. Readers may surf the web for "Rubik's cube" to access to many interesting sites on this.

The aforementioned points highlight the need to strike a delicate balance between offering our students the best practical values of the course, and at the same time teaching them the foundational skills. However, it seems that the importance of the latter often eludes many. Even if it is accepted, it is often not accorded with as much appreciation as it deserves. Here are a few possible explanations.

The ‘Six-and-a-half cookies’ syndrome.

Refer to Article 1-2 for this favourite bedtime story of mine.

The School of Computing conducts annual employment surveys on our fresh graduates. Two of the survey questions are “Which is/are the most useful module(s)?” and “Which is/are the least useful module(s)?”

But you won't pass
these modules if you
didn't do well in
level-1000 modules.

- a senior

Not surprisingly, high-level modules were commonly cited in response to the first question, while the least useful modules are usually the 1000-level modules and modules that were not directly related to the graduate's field of work.

Like the first six cookies, the contribution of groundwork is easily forgotten. Marathon runners are cheered on at the finishing line, not at the starting point, nor at their practice sessions.

The ‘Market-value’ syndrome.

Related to the preceding discussion, there is a tendency for people to measure the usefulness of an academic course by its direct and immediate relevance to the current job they hold. The major users of today's computers are not scientists but administrators and industrialists. Scan the job advertisements in the newspapers, and read the requirements spelt out for job applicants. What most employers look for are familiarity with popular software packages and hardware systems. Companies want their staff to be productive as quickly as possible.

Hence, courses that are directly related to these marketable skills are deemed the most useful. Impatience is human nature and some students could not wait to get to the good stuffs. Consequently, they pay little attention or put half-hearted effort on the fundamentals, thinking that these are unnecessary, or a hindrance to their enterprise.

The great myth.

I was wrong. The major users are not the administrators or the industrialists. With the rapid rise in computer literacy – thanks to the increasing ease of use of software and affordability of hardware, proliferation of the Internet, as well as the government's concerted efforts in promoting information technology – the bulk of the users now are the common people, from the five-year-old preschooler who uses the computer for her nursery rhymes, to the 80-year-old nanny who surfs the world wide web for pastry recipes.

While most of us started our grounding in other sciences such as physics and mathematics early in our formal education, our first encounters with computers are mostly through informal and leisure activities. This creates an interesting dichotomy. On one hand are the serious and well-informed computer scientists and practitioners, while on the other hand is a bigger and growing cohort of hobbyists who know something about computers. Through their own personal experiences with Visual Basic, StarCraft, Microsoft Windows, and World Wide Web, this latter group of users formulates their own notion and perception of programming, computer graphics, operating systems, and computer science. The misconception that computer science is an assortment of simple-to-learn, fun-to-use application software and toys spreads quickly across the community and exerts varying degrees of influence on our in-coming freshmen, who may carry these incomplete views that mislead them into trivialising the subject.

1.7 Learning About Learning

Many fresh graduates quickly realised that only a fraction of what they learned in the university is directly related to their job. The real world out there is so different. To remain relevant and useful in the field, the saving grace is often not the know-how you learned in school, but the ability to adapt to the ever-changing environment, and the adeptness in learning new things.

This is why students are urged to read beyond their textbooks, so that their views are not shaped by the ideas of just a few authors. In higher-level modules, greater demand is levied on the learners to read up on research papers in scientific journals and magazines that report on the current trends and innovations, instead of relying solely on textbooks which are consolidation of relatively dated materials. Nowadays, the Internet provides another vast source of information, cutting down tremendously the time lag between the birth of an idea and the time it gets to the print.

Students who take the initiative to widen their horizon through reading extensively and learning things outside the curriculum on their own at every opportunity will find the habit pays off when they eventually enter the workforce. In essence, the most important thing you should learn is not about the subject matters, but about learning. And this is not taught in school.

Students are also advised to engage in deep learning now instead of surface learning to reap better benefits [5]. Deep learning is characterised by an intention on the part of the student to seek the underlying meaning of the subject they study. He relates the new knowledge to previous experiences. Surface learning, on the other hand, is characterised by rote memorisation and concentrating on one specific task. The learner employing surface learning might hence compartmentalise his knowledge and miss the hierarchical structures of the ideas.

Indeed, electrons
travel faster than
ink.

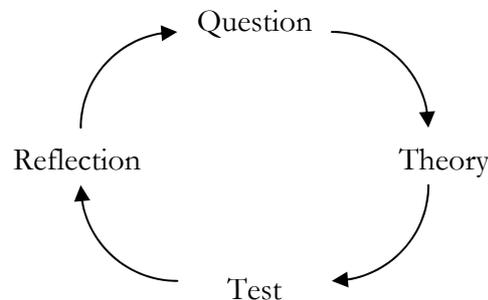
To understand a little more about the process of learning, let us take a look at the following material that is extracted from the book “The Age of Unreason” [4] which carries a good discussion on this topic.

First, we need to correct some myths on learning. The best way to do this is to state what learning is not.

- ✗ Learning is NOT *just knowing the answers* as in rote learning, because it does not help you to change or grow. It does not move the wheel of learning (see below).
- ✗ Learning is NOT *the same as studying or training*. It is bigger than both. It is a way of thinking about things.
- ✗ Learning is NOT *measured by examinations* but measured by a growing experience.
- ✗ Learning is NOT *automatic*. It requires energy, thought, courage and support.
- ✗ Learning is NOT *only for the intellectuals* who often shine at the thinking stage, but are incurious and unadventurous.
- ✗ Learning is NOT *just finding out what others already know*, but it is solving our own problems for our own purposes, by questioning, thinking and testing until the solution is a new part of our life.

This is an example of abstraction.

The process of learning could be depicted as a wheel:



The wheel of learning begins with questioning, where a problem is identified. The next stage involves generating theories and ideas to answer the questions. To validate these theories, we must then test them, after which we should reflect on the results, on why it worked, or why it did not. The outcome of reflection spurns a new cycle.

If the wheel is not turned, you are stuck in one phase. Some people never ask questions, and so the wheel does not even start. You are to avoid falling into one of the following categories.

- ✗ The *question specialists*, the small children, who keep asking questions, for the sake of asking, but never learn.
- ✗ The *theory specialists*, the bad academics, who are full of answers to other people's questions. They know a lot but learned little.
- ✗ The *testing specialists*, the action men or pragmatists, who have no time for theory or for thinking. Their immediate reaction to a problem is to attack it with the tools nearest to hand. 'I kick it, that usually does the trick' is their formula.
- ✗ The *reflection specialists*, the pundits, who keep rehearsing the past. They have learned, but stop there – one lesson is enough.

Are you one of these specialists? You'd better not.

Each of us has our own strengths. Some of us might be born theorists, while others are inclined towards practical activities. However, a complete learning experience is a balanced one that involves all facets, each exercising on different mental faculties. We do not expect everyone to possess all these qualities and capabilities at equal level, but we would not like to be lopsided in our learning either.

1.8 Course Of Actions

Now that you have been through a quick orientation on university learning, it is time to devise a plan to position yourself favourably in your pursuit. Here are a few strategies that might be worthy of your consideration.

- ❖ *Change of mindset.* You are to shed your old mode of learning and be an independent, inquisitive learner who embraces deep approach to your learning. Adopt an open mind, and respect knowledge in all spheres and disciplines.
- ❖ *Know yourself.* Capitalise on your strengths and work on your weaknesses. Assess your capabilities and set realistic goals.
- ❖ *Monitor your progress.* Draw a chart and mark the points when you should check your own progress. Keep to the schedule and take remedial actions when you fall behind.
- ❖ *Form study group.* Team up with a few of your fellow classmates. Such affinity group also builds rapport that provides intangible benefits. To be effective, the members must share common objectives and are serious in their participation, otherwise the study sessions will degrade into chit-chat sessions and canteen outings.
- ❖ *Take responsibility for your own learning.* At this stage of your education, nobody will run after you for missed classes and assignments. You are to assume complete responsibility for your study.

Attitude matters more than aptitude.

Finally, do not fall prey to the ‘I know that...’ trap (see Article 1-3). Often, many of us know exactly what needs to be done, but for some reason, never make it a real practice.

In the university, the lecturers are no longer knowledge providers; they are now assuming the role of facilitators. You are now taking full responsibility for your own learning, so you should retain control and never let things get out of hand.

1.9 Summary

This chapter presents the immediate challenges awaiting you, which include cultural changes in the living and learning environments. It offers some pointers to the new students, particularly the international students, on how to adapt and cope with the changes.

It covers in fair amount of details what higher learning entails and what pitfalls you are to avoid. It also provides advice on how you could prepare for a rewarding learning experience.

Knowing the fundamentals, being able to separate examples from principles, and developing good abstraction skill are essential for effective learning. Having a good grounding in the theoretical basis, and taking the initiative to keep up with the rapid developments are also keys to success.

University education lays the foundation for lifelong learning. The process of learning is unveiled, and some working strategies suggested. In conclusion, learning now takes on a whole new meaning, and you are to take on a more proactive role to meet the demands of higher education.

Article 1-1: Learning and Jigsaw Puzzles

A *GOOD* many undergraduates, plagued by the **apparent shift** in the approach to learning so required of them, coupled with a similar shift in the teaching style of the professors, see the initial months of their university education as a period of boggling at the traumatic change. While the cause of such affliction is manifold — and so is the problem itself — the evolution process which moves the emphasis from facts remembering and formula application in the earlier stage of education to training in **analysis and synthesis skills** seems to have taken many a student by surprise. Perhaps a little more understanding of the elements of effective learning methods might help to relieve the tension experienced by these people during the metamorphosis phase.

For a person who has negligible knowledge on the cognitive aspect of learning, it has never been any easier to present an analogy for the high-level learning operation than to identify the characteristics of such cognitive mechanism, until one fine evening, while fiddling around with my jigsaw puzzle, a small discovery struck me miraculously. The act of fitting pieces together in a jigsaw puzzle resembles, to some extent, the mental effort we make in **assembling and assimilating** small chunks of information to form the so-called knowledge base — an amalgamation of our very own past experiences.

The principle in force in solving jigsaw puzzles is simple — fitting compatible pieces together. And so is in learning, where we search for **connections** among our assemblage of pieces of knowledge. Two essential techniques come into play here: **association** and **differentiation**. Through association we identify the obscured relationship among seemingly disparate items, as in discovering two complementary pieces that go together. And through differentiation we seek to detect the concealed differences between two apparently similar items. Such actions give rise to a clustering effect that is useful for a few reasons. Firstly, it reduces the chances of us being overwhelmed by an unwieldy overload of information, and secondly, the building up of the clusters en masse induces smoother cluster formations. In simple terms, just like solving jigsaw puzzles, the more we learn, the easier it gets, and the more skilful we become.

Inevitably, errors might be made in the early part of the game. You might have mistakenly concatenated two unmatched pieces. Fortunately, the game possesses a **feedback mechanism** which makes it a matter of time for such mistake to be uncovered once the right piece is brought under inspection. In the learning process, realisation of the need for such corrective action may take place much slower, but this is not the issue. What is significant is the role of the feedback device which involves the **re-examination of old results with new facts**. The key idea is an **open, inquisitive mind** to overpower the propensity for accepting things as they are, as well as the unwillingness to dilapidate previous effort. Such a mind is what makes a person a better learner than another.

The experience that we gained in solving jigsaw puzzles, as in learning, is something very **personal**. When I worked on my jigsaw puzzles, I began with the pieces on the edges and corners, and grouped the rest by colour composition, and further grouped them according to their shapes. You may choose to do it in just another way. This exemplifies the breaking down of a big job into smaller tasks, through some **systematic, well-defined strategy**, for we know very well that voracity brings on nothing but indigestion. The existence of more than one strategy implies that some amount of **flexibility** is possible. It is left to the player to exercise his creativity in experimenting with different schemes and choose one that fits best in terms of his intention as well as personality.

Solving jigsaw puzzles is both **goal-oriented** and **process-oriented**. There is certainly a clear goal: to frame all the pieces into one complete picture. But the joy does not emerge only at the very last few seconds of the project. Indeed, if that is the case then it must have been such an unbearable toil during the many hours of work that the person might not even persist to complete the task. Ask any jigsaw puzzle fanatic, and he will tell you how he enjoys the hours of grappling with the shapes. No doubt the momentous joy of achievement is great at the point of successful completion, but perhaps what is more meaningful is the **delightful feeling that is experienced throughout the undertaking**, say, when you discover the connecting element to two disjoint sections, or when you come across the long sought piece that is needed to fill the gap in a difficult portion. Sometimes, even just by sitting back and appreciating the half-done work can be a very wonderful and rewarding experience in itself! Only then would it make the whole business of learning less of a boring chore and more of an inspiring and pleasant experience.

Of course, learning is not equivalent to solving jigsaw puzzles per se. Inasmuch as there are almost always similarities and differences between two objects, the analogy has to stop somewhere. Learning encompasses much more than the simple, two-dimensional view that the jigsaw puzzles can suggest. Many issues like the **holist** and **serialist** approaches to learning do not find their place in the analogy (though jigsaw puzzles is holistic in nature). Nevertheless, we have just learned something valuable from this favourite humble pastime. For all we know, learning involves a lot of effort. **Learning to learn probably involves more.**

Aaron Tan
June 1991

Article 1-2: Six-and-a-half cookies.

A HUNGRY man looked around the house for food and to his delight, he found a jar of good cookies. He picked out one and finished it in no time, but it did not satisfy his urge. He took another one and it did not help much either. "I'm still as hungry," he grouched. So he took the third, the fourth, the fifth and the sixth. Each time he finished munching one, he would lament that it had not filled his stomach. When he finally got to the seventh cookie, he stopped mid-way, and happily proclaimed: "I'm full now!" But he thought to himself: "Oh, silly me. I should not have wasted my effort on the first 6 cookies, had I known that half a cookie is all that it takes to do the job!"

Don't say you never think like this. 😊

Article 1-3: The 'I know that...' trap.

I WAS working with one of my clients (let's call him Perry) recently.

We were checking the marketing systems of his company and discovered some glaring holes. At the end of the day, we put together a long list of actions to be taken by Perry.

While going through the list, he stopped over so often and muttered "But I know that...", indicating that he knew that he had to do those basic points of doing business, which were on the list.

They were basic. Yet, I had to put them on his action list because Perry was not practising what he already knew.

He had become another victim of the "I know that..." trap.

The true secrets to success are all those small steps that everyone knows, like answering the phone in a courteous manner and delivering on time, that seem so logical, that you tend to forget them in your daily life.

I have seen thousands of people searching for the "magic formula" to success. There has to be some great secret to it all, they think, something truly fundamental, big, tantalising.

That is why many people forget about the basics - the "I know I should be doing it like this..." stuff.

Yet, that is where the secret lies. The next time you hear good old-fashioned advice, don't filter it out immediately: Take the chance to check your systems and make sure you are using all your basic tools.

The secret is that there is no secret: Practise the basics that you already know and be successful beyond your wildest dreams.

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