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Original Paper

Creating a Learning Environment that Promotes Critical Thinking for Tertiary Students

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Abstract

A significant need and an important characteristic of learners in higher education is to be creative and critical thinkers. This paper discusses briefly the changes that have taken place in the learning environment since the time modern learning process began in 1800. Further insights into teaching and assessment methodologies, focusing on fostering and cultivating critical thinking (CT) in learners, has been gathered from educators in tertiary institutes. The data gathered helps to identify where there is a deficiency in the learning process that fails to produce graduates who are critical thinkers, to what level the management of a tertiary education provider commits to garner students who are critical thinkers and asks is there a need to have a stand-alone CT module in the curriculum in tertiary institutes. A conceptual framework that depicts the use of CT methodologies at the lower tertiary levels is proposed.

Keywords: Critical Thinking (CT), Higher Education, Self-Directed Learning, Assessment Methods, Teaching Critical Thinkers

1. Introduction

Rote learning has been embedded in the curriculum since education began and still has a role in the learning process. However, it is inarguable that to benefit society and meet the aspirations of individual learners, higher education must empower critical thinkers. Questions like *what*, *why* or *how*, must stimulate the learning environment. With the advancement of technology and a continual transformation of educational methodologies, it is pertinent to examine if the curricula developed by universities and colleges cater to the learning needs of critical thinkers.

Students with interpersonal intelligence and creative thinking have the potential to become leaders in all spheres of life and this is self-evident for engineers. Tuula Teeri, President, Aalto University in Finland, has asserted that future engineers will learn less from books and lectures and more from other learning platforms such as the internet. In consequence, ensuring that online resources of learning are reliable has become an important part of the university lecturer's job. Concurrent collaboration with entrepreneurs and engagement with companies will give students an opportunity to gather real world knowledge to inform minds that are receptive to critical thinking (CT).

"Our students are powerful entrepreneurs – they have a huge capacity, much more than my generation. In engineering education, we should begin to give a lot more responsibility to our students, because, after all they are the ones who are going to build the future" – Tuula Teerin, Aalto University, Finland(Olson, 2013).

Bransford, J.D. et al in their book "How People Learn: Brain, Mind, Experience, and School", emphasise the need to change the learning environment by changing the goals of learning. The modern learning process began in the early 1800s with classrooms being places for educating students to be able to write texts from oral instruction as the highest educational goal, to learning environments in the 1930s becoming factories that efficiently processed children who were the raw material to deliver the end product of mass education. As society changes, so learning goals have changed (Bransford, Brown & Cocking, 2000).

As literacy around the world has increased and the number of schools has grown, a point has been reached where the education system in its entirety has been flooded with educational policies that are unlikely to work in the best interests of all. Though it is clearly in the general interest of all students that these policies are set in standard operating procedures, some of them cripple the growth of students who display the potential for creative and CT. Today's critical thinkers in the classroom are tomorrow's outstanding scientists, engineers, technologists, doctors, writers and artists. The work of Levy and Murnane (2004) (as cited in Pellegrino et al, 2012) recommended that schools teach all students complex communication and non-routine problem solving competencies along with the usual verbal and quantitative literacy, in lieu of their prediction that jobs requiring low and moderate levels of competence will continue to decline in the future.

Through primary data collection from a small but selective sample, this paper provides an understanding of the extent to which CT is promoted in undergraduate learning and how teachers have incorporated models and teaching and assessment methods to meet the needs of critical thinkers. It also evaluates the levels of support educational institutions offer to the teaching and assessment of critical thinkers in both technical and non-technical disciplines.

Goals for engineering educators must be to encourage students to continually improve and keep learning throughout their education and career. Students of engineering and technical studies must be able to understand and interpret their assignment questions identify their assumptions and determine whether they are justifiable. Answers must be clear, accurate and relevant to the question. Instilling in students the love of thinking and respect for thinking will help them to realise the importance of CT. Students who possess CT skills show increased ability to identify and comprehend problems and provide reasonable and quality solutions to these problems. The learning environment may be learner centred, knowledge centred, assessment centred or community centred(Bransford et al., 2000). No matter what inclination the learning environment has, CT must become an integral part of the curriculum.

In this paper, a qualitative analysis is provided from responses generated by lecturers and senior lecturers in the field of business management and engineering, from private higher education institutes in Singapore, Malaysia, UK and Ireland. A survey questionnaire was designed with questions relating to CT approaches and the need and importance of CT to be embedded in the curriculum of higher education modules. This paper provides a narrative analysis of the responses that were collected.

2. Literature Review:

2.1 Need for a Critical Thinking Module in the Curriculum of lower tertiary programme

The requirement for a curriculum to include a CT module is currently uncommon, but at the same time, CT is not excluded in taught modules. To a large extent, the module's lecturers and tutors are the implementers of tools that make learners into critical thinkers. Lecturers and tutors may use different teaching methodologies and tools to enable CT to get students to solve problems based on similar approaches. For example, constructivist teachers encourage their students to constantly assess what they have learnt through an activity (Educational Broadcasting Corporation, 2004). With the help of a constructivist classroom, students can become expert learners. To help student learners to become excellent in using thought processes, the outcome of which will help them to grow into responsible citizens, a systematic approach is required. Even if lecturers are fully inclined to develop a systematic approach to encourage and develop critical thinkers, support from the education institute is crucial. However, in a curriculum that does not explicitly state learning outcomes that require teaching CT, the lecturers may not want to be constructivist teachers who include tools or methodologies that allow or encourage CT in the classrooms. This may be for several reasons, such as time constraints to complete the syllabi, students who are particularly weak learners, lack of support from programme management on the use of tools, teachers being unfamiliar with Socratic tools that could be used to prompt students to think and numerous other factors. The narrative analysis of this paper has also identified responses pointing to the reluctance of using CT tools in the classroom. A CT module alone that is included in the curriculum may overcome the reluctance of using the tools and also other challenges that are barriers in making critical thinkers.

The *Foundation for Critical Thinking* states that a common perception from research into CT reflects that human thinking left to itself often gravitates towards prejudice, over-generalisation, common fallacies, self-deception, rigidity and narrowness (Elder, 2007). As the nature of CT is self-directed, self-disciplined, self-monitored and self-corrective, it can however be difficult to measure and evaluate the work of critical thinkers, unless and otherwise there are proper evaluation and assessment techniques. The assessments that are set and designed to measure the work of critical thinkers must be in line with the achievement of the learning outcomes of the modules. Lecturers may insist that students use tools like Why-Why analysis, SWOT analysis, Decision Tree Diagrams, Fish bone diagrams etc., in order for the students to generate creative ideas and be able to solve problems in an evaluative manner and also explicitly show the synthesis of information assimilated.

Many UK universities like Keele, Bishop Grosseteste, Lincoln and others have included CT modules in their curriculum for some major disciplines. For example Keele Univeristy offers the module "Reflective Teaching: Critical and reflective approaches to teaching in secondary education" (Keele University, 2017). This module is offered at level 5 for teacher education, which is considered important to teach and encourage students capable of CT. The teaching force must also be critical thinkers. The module is available as a free-standing elective and the objective of the module is to explore critical and reflective learning and its applications to various schools and subjects. It draws primarily on constructivist learning theory. This further helps to establish constructivism as a paradigm in teaching and learning. A constructivist classroom is where the focus is on the students and their learning process through active engagement in the construction of meaning and knowledge rather than them being passive learners waiting for their teacher to fill them with knowledge (University College Dublin, n.d.).

2.2 Theoretical framework - Model for critical thinking

Duran, Limbach and Waugh (2006), identified and presented a "Critical thinking framework for any discipline", in the International Journal of teaching and learning in higher education. This framework has been widely used by many virtual and physical learning organizations that aim to move learners into an active-learning environment. The framework was developed by these researchers, who based it upon Paul and Elder's Model of CT and also Bloom's Taxonomy that identifies the six levels of cognitive domain (Duron, Limbach, & Waugh, 2006).

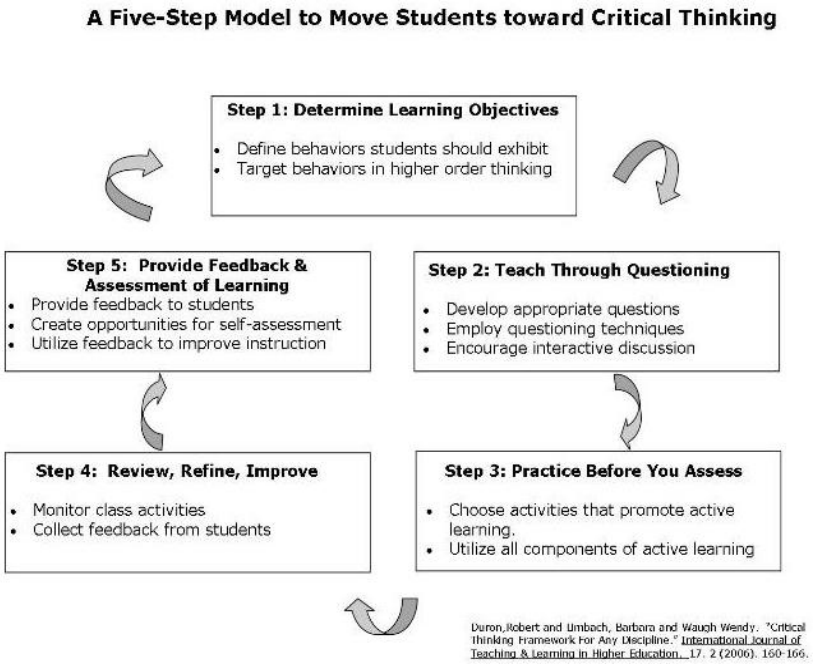

Figure 1. A five-step model to move students towards Critical Thinking (Duron et al., 2006).

2.3 Conceptual framework

A curriculum that is inclusive of tools that encourage and nurture creative and critical thinkers is proposed. A constructivist classroom differs from the traditional classroom in ways which include teacher-student interactions and dynamic group activities ("Constructivism as a Paradigm for Teaching and Learning," 2004). The model shown in Fig.2 may be used in tertiary education academic management as a guide to include CT either as a module on its own, or to be incorporated in every taught module that is already in the curriculum. Further, the individual academic departments can lay out a more specific protocol, as to what content must be used in the delivery of the lessons in which CT will be a major portion.

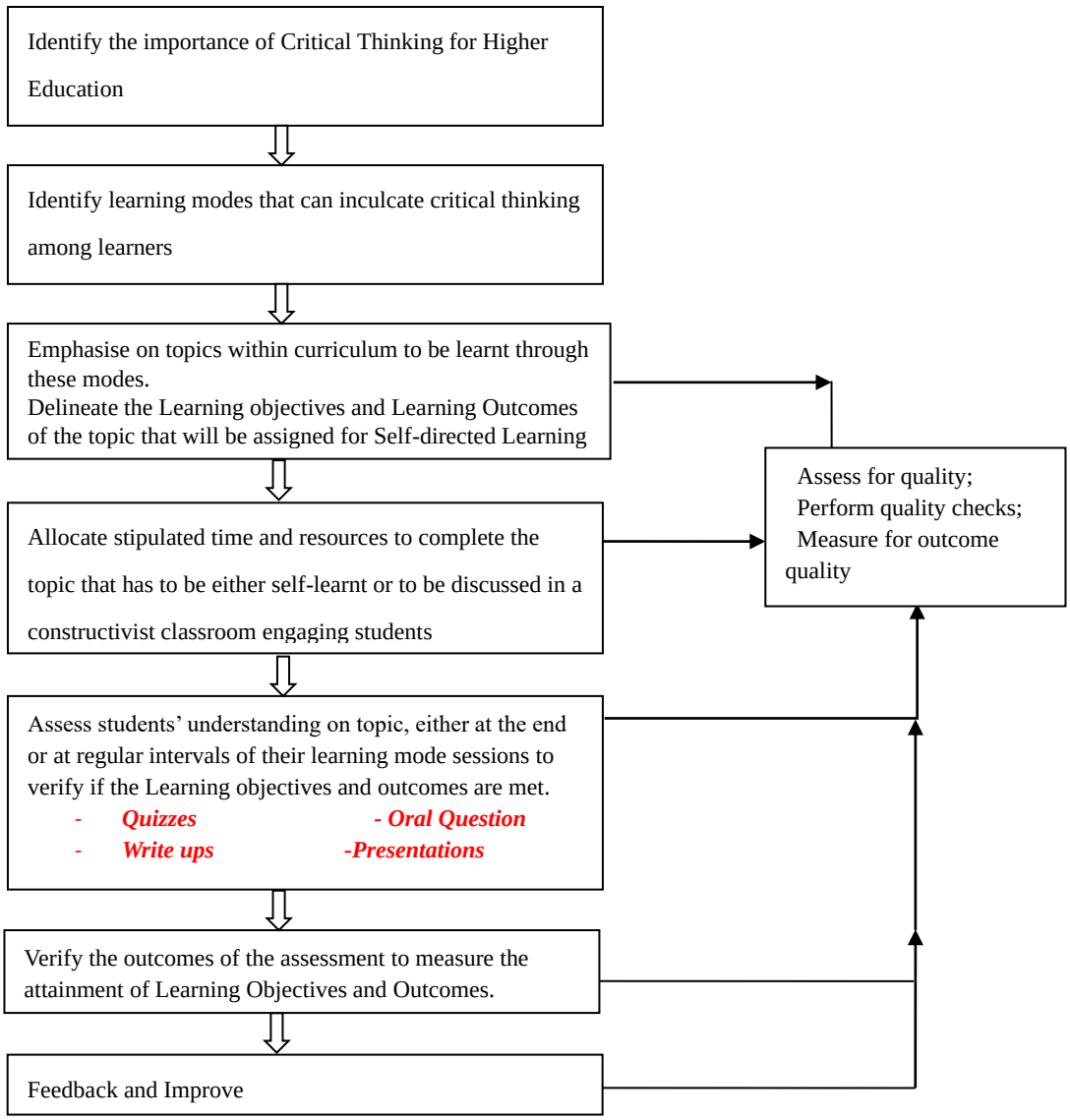

Figure 2. Steps to include Critical Thinking into Taught Modules

The flow chart in Figure 2 is indicative of the steps in the process of inclusion of CT which initially starts with the identification of the importance of CT in higher education. The next step is to identify the modes that can inculcate CT among learners. An example would be to use self-directed learning of a specific topic or engaging students in a constructivist classroom. Further, the topics within the curriculum that can be learnt through these modes is emphasised as it enables CT in learners. The

learning objectives and learning outcomes for the topic that is assigned for self-directed learning must be clearly delineated and learners must be explicitly informed about these objectives. However, they must be designed in a way that demands learners to be critical thinkers and problem solvers.

Once this is done, a stipulated period of time has to be allocated for the completion of these topics. Students as self-directed learners may or may not be well-cultivated critical thinkers. In order to help them achieve CT, self-directed learning modes must include interim sessions that test the knowledge gained by students who have been assigned self-directed topics to learn. This can be done through assessments that help in the identification of whether the learning objectives and outcomes are attained successfully. After this, outcomes of the assessment must be verified to check if the learning objectives and outcomes are attained and a general indicator on how the students have performed as critical thinkers may be understood. The entire process needs quality checks at regular intervals, to ensure that CT is facilitated at every step.

The model proposed in this section can be used by lecturers and academic management staff for different cohorts. The data analysis will give insight into how students react to CT activities in class, what current practices are lecturers following to exercise CT in classrooms, is there room for further modes of learning that may require students to be critical thinkers, to what extent is there support from higher education institutions and additionally answer a few other questions.

3. Narrative Analysis

The CT community visualises the feeding of endless content to students as analogous to repeatedly stepping on the brakes of a vehicle that is already at rest (Elder & Paul, 2009). A purposive sample group of higher education educators were surveyed with open ended questions and the results have been compiled here. 25 selected respondents participated in the survey and recorded their responses, some of them in hard copy and the others in soft copy. The answers given by respondents helped to confirm some hypotheses on how educators inculcate and encourage CT in classrooms. Most educators overemphasise the coverage of syllabi over the engagement of students in the classroom through Socratic tools that may enhance their thinking capabilities.

Higher education lecturers (including some senior lectures) who had agreed to be respondents gave an array of inputs for questions on what methods in teaching they used to encourage CT. The responses to an open-ended survey are collated in this section to reveal information on the need and possibility of including a Critical Thinking Module in the curriculum. Respondents are lecturers who have taught or are currently teaching at the lower tertiary levels and also those who are teaching higher levels of tertiary programmes in Singapore, Malaysia and the UK. Replies are collated here under the headings considered by the respondents.

3.1 How Important for Higher Education students is it to be Critical Thinkers?

All respondents agreed that critical thinking at higher education levels is important and rationalised that it is the mindset of the students that reflects on their future development and progress. This progress is enhanced through critical thinking. Also for autonomous learning and to help students develop innovative skills, they agree that CT is of utmost importance. One of the respondent wrote *"very important or should I say critically important. The modern economy requires problem solvers who think critically and produce solutions to problems that are logical, critical, and relevant by putting together ideas, concepts and patterns that they observe around them".* Another respondent emphasised that it should be implicit to learning, while yet another stated that knowledge and understanding is constructed through critical thinking rather than memorization of facts.

3.2 Methods employed to teach the curriculum that emphasised Critical Thinking

Case studies, interactive class discussions and group discussions were the methods that were chosen by most respondents. Other methods that were used, but not by many, were role-play based on scenarios, research on a project and presentation of findings in class, problem-based learning, storytelling by lecturers and asking students to relate these stories to some other incidents in their real lives, use of tools like mind-maps, fish bone diagrams and decision trees to ease the understanding of complex problems, concept design and demonstration for better understanding of the problem. One of the

responses described using a game, in which the class was separated into groups and a problem was given to them. Solution had to be proposed by one group, which must be opposed and argued by the others, who were expected to provide better solutions than the first. This approach is far removed from didactic teaching and would work well in making good critical learners. Another respondent teaching on the Keele University's program used the pedagogical aids that are provided by the university. Another respondent used the ASK, APPLY, LISTEN to each OTHER, DEBATE method, to encourage students to think beyond normal expectations. On the use of any innovative or unique methods used in teaching, only a few lecturers revealed they had used such methods. One of the responses was illustrated by the example where students were given an explanation on the topic, for example a risk audit. In such an example, the students were asked to walk around the campus that they were studying in, to conduct a risk inspection, record hazards and thereafter complete the risk assessment matrix. This gave the students a hands-on experience of the entire process and also their thought process improved by applying the kinaesthetic mode of learning.

3.3 How have syllabi been covered if a critical thinking approach has been adopted?

In answer to how have the lecturers covered the syllabi in cases where CT had been used, there were a variety of ways and strategies used. Facilitation and integrating CT with classes through activities was only considered by a few to be implicit to teaching the course. These respondents were constructivist teachers. Another respondent explained that the students were asked to search for a website to be tested using automated testing related to the syllabus. They were asked to use various testing strategies and then give their critical views about the security of the site and how well quality assurance activities had been carried out. Also, they had to suggest how the site could be improved based on their observation and analysis.

As a result of using CT, one respondent was prepared for many more questions on certain material from the students and introduced the concept of peer assessment among the class to optimise learning and critical analysis, by making them responsible for what and how they learned. This was an excellent demonstration of Socratic questioning as described by Paul and Elder in their website, titled The Critical Thinking Community and copyrighted by Foundation of Critical Thinking (Paul & Elder, 1997).

Most syllabi in recent times have been novel in proposing higher order thinking, yet they have been implemented as rote learning. Implementing CT approaches in the classroom could better achieve the learning objective of the subject.

One of the lecturers even gave a lesson time breakdown for 50 minutes, as to how the syllabus was covered as follows:

Introductory Discussion of Topic (Anticipation)	5 minutes
Lecture Segment, Paired Discussion, Square the Pairs	15 minutes
Class Discussion Using Questioning Techniques	10 minutes
Quick-Write Activity (Individual Summary and Reflection)	5 minutes
(Summary)	5 minutes
Value Line (Reflection)	10 minutes

From the above responses, it is evident that CT could be integrated into teaching of modules within the stipulated contact hours if teachers wished to, irrespective of whether it was mandatory or not.

3.4 The extent of support and appreciation received for analytical work

Many respondents mentioned that analytical work was supported greatly, especially at higher levels and it was evident in examinations and assignments set. Laboratory technicians and other staff members supported activities that involved CT. One of the respondent stated that the support was considerably effective, as long as the lesson plan strictly indicated the topic coverage and methods used. Another

respondent had given input that *"analytical work is encouraged in Government school curriculum from the primary level to a large extent in the secondary school syllabus".* Hence at the tertiary level, this type of work could be brought in to enrich classes and establish the relevance and impact of CT. One of the respondents mentioned that overall support for CT was limited, but if the challenges could be overcome, the improvement, though not apparent at the outset, could still yield benefits. On the other hand, there were responses that stated that support was rendered for classes in which these techniques were used. The lecturer who asked the students to apply different testing strategies and got the students to analyse the difference between them, commented "*I think the students were interested in this approach rather than just theory classes. It gave them an insight into the requirements regarding website development. They were willing to learn new tools to be used in the testing process. Their work was graded based on the types of tools used and their analysis based on their tests".* On another note, yet another respondent stated that institutional support was not given to a great extent and so most lecturers delivered lessons very methodically without engaging students in discussions and CT.

Providing clues to support coursework in class and adopting an open door policy of academic staff are ways that encourage and support students to develop their critical thinking skills. Plymouth University provides SUM:UP: a drop-in centre that encourages students who may need one-to-one help in areas like numeracy, maths and statistics related topics (Plymouth University, n.d.). The approach to learning, as described on their website, reflects an open door policy where students can ask for help in order to develop their understanding of complex topics and also, in the process, develop into critical thinkers.

A lecturer who taught at the lower tertiary levels mentioned that not all students appreciate such techniques (measures to promote CT). Most of them were focussed on learning just enough to complete their assessments and hence expected to be spoon fed. Another respondent stated that for many students, especially international students who might not have undergone a problem-based pedagogy in their early education, CT and analysis did not seem important. However, in this data-driven world, organizations are constantly looking for the heightened skills that CT provide.

From these responses, it is apparent that even though lecturers want to use a critical thinking methodology in class, learners at lower tertiary levels may not share their keenness to learn under such a regime and may become disconnected. However, this reluctance could merely be because the learners were weak in either language proficiency or in academic knowledge and capability. Similar responses are highlighted elsewhere in the paper.

3.5 Differences between cohorts taught to be Critical Thinkers and those who were not.

Those who were not taught to be critical thinkers were seen to be less competent and often also their language proficiency did not support them to be critical thinkers. Those in lower level programs, who were not exposed to CT, developed limited descriptive and superficial answers to assignments instead of demonstrating any depth of understanding of the topic. Those who were taught CT were perceived to be broader minded and more ready to face the challenges posed by higher education. Those who were not taught CT lacked creativity and this lack apparently has greater visiblity in US schools than in Asian schools where teaching methods are recognised as more stifled.

Differing levels of confidence, initially in first level students and also higher dependency among 2nd level cohorts, has been witnessed. Another similar response stated, Stage 2 students who are not taught CT can be introduced only to simpler problems than those who were taught Critical thinking at stage 4.

"Cohorts that I've implemented critical thinking tend to produce students who are more relational to one another, produce ideas and thoughts that challenges the norm, and overall display better self-confidence in presenting ideas and speaking in general", stated one response.

3.6 Positive or negative impacts from using innovative/unique methods of teaching that encourage critical thinking.

The responses seeking insight into negative impacts were quite varied, owing to the fact that students were observed to respond differently to the use of innovative/unique methods. Many students seem to be indifferent to the innovation in methods used to impart learning. To them, the unique thinking and delivery is merely just a part of the lesson.

Some students/educators are used to outmoded processes and are unable to accept these methods. In fact, due to cultural norms students of certain nationalities are unable to accept the education as being rigorous and of reaching a satisfactory quality standard unless traditional methods are employed.

Some positive impacts identified were better understanding by the students and the establishment of closer student-lecturer relationships, methods supportive of students' perspective towards learning and better learners who were ready to face job market demands. However, it was considered as benefiting only to those students who were keen on pursuing higher education. This indicated that a CT module may only work well amidst keen and intellectually capable learners. On the plus side, greater latent creativity is set free. Often at times, skills were developed despite the limited learning and social backgrounds of the students. Students emerged as better thinkers and problem solvers. However, among many students, methods encouraging critical thinking created resistance and sometimes even resentment. Good students thrive on such methods, but in a typical cohort, the 20% weakest students struggle. Students were able to write more by asking questions, giving their own opinions and backing up their claims with documented evidence.

One respondent mentioned that "*Students showed interest in their work. They were able to understand better why testing is done and how it should be done and their implications. They were able to voice out their ideas too*". On the other hand the same respondent identified the downside that "*on the negative side sometimes they become too critical without realizing the other factors that contribute to the limitations of the design"*. Other negative impacts that were recorded were that there were time constraints in completing syllabi when such new methods were introduced. Also lecturers feel that self-directed learning in many institutions receives low evaluation scores for lecturers.

While relatively few positive impacts were stated for CT, some thought that the methods might be more effective when introduced in schools. CT methods are unlikely to be welcomed by all, but those for whom it works are able to stand out through their ability to apply critical thinking.

Yet another respondent shared the following thoughts on positive impacts.

- Students share in the **responsibility** for classroom environment
- Teachers **model** thinking and support students as they share their thinking strategies
- The classroom has an **atmosphere** of inquiry and openness
- Students are supported, but also **challenged** to think independently
- The classroom **arrangement** allows students to work together.

3.7 Scope for introducing (further) self-directed and self-disciplined learning into a taught module

73% of the respondents agreed that there was scope to introduce or to further expand the use of self-directed and self-disciplined learning into modules that they taught while 20 % of the respondents felt that it was not possible. 7% did not respond.

3.8 Perceived impediments and positive consequences

Not every student was considered to be capable of undertaking self-directed learning; each student is unique and may or may not adhere to self-directed learning. One respondent also stated that if there was too much dependence on self-directed learning, there may be a hindrance to further development of knowledge. Society is still not open to a CT curriculum and they are not widespread in Education Systems. Another hurdle that was mentioned by a respondent is a major concern for many educators which is that it is not easy to convince the management to go for self-directed learning and this is particularly true of Private Education. CT approaches might not be suitable for cohorts of students who are struggling to understand (a) language or the medium of instruction, (b) the theories of marketing, (c) the spelling and meanings of new abstract terms.

A positive consequence would be that CT tends to produce learners who are creative and thinking individuals as opposed to rote learners and gives them the opportunity to explore at greater depth in a discipline. It is reasonable to argue that students would have better understandings of topics/modules that were self-learned. Through home based assignments and assessments, students will learn

self-discipline and independence. Education systems that promote CT will continue to see better outcomes. The abilities of engineers, doctors, architects etc. will increase. It is quite a positive thing for students to take their own learning into their own hands; it teaches them responsibility and whether or not a student starts employment demonstrating responsibility will establish their future careers. The positive consequence is that students at every level are challenged with changing conditions of the environment. Their ability to apply standards and for them to transform their knowledge with changing conditions, positions them in a very practical world. Self-learning requires discipline and commitment. If the students are interested in the work given to them they will carry it out well. A positive effect will be a clear understanding of the related study. It produces good results by promoting lifelong learning and gives solution providers to an ever changing and challenging society. Positively, this might enhance students' creativity and allow them to 'think out of the box' when attempting coursework. Not only that, self-motivated students will be able to achieve their individual targets within their own schedule. Negatively, some students thrive only by micromanagement. Giving them free reign might not give them a sense of urgency to complete their work and thus affect an institution's KPIs.

The shorter durations of courses (as institutions are currently awarding diplomas and degrees more readily) have students more interested in answers being fed to them than in taking the time to think and explore. Having students who are from different countries also exposes language and cultural barriers. Most Asian students expect to be taught rather than to learn (Chuah, 2010). On occasions where some students were cohesive and took initiative, a significant increased participation throughout the class ensued.

3.9 Potential for introducing (further) self-monitored and self-corrective thinking into taught modules

73% of the respondents saw that there was a potential for introducing or furthering self-monitored and self-corrective thinking into the modules that they taught, while 20 % of the respondents did not see the potential. 7% did not respond.

3.10 How can we assess the quality of self-monitored and self-corrective thinking?

There were varied responses to this question, however most participants agreed that to assess the quality of self-monitored and self-corrective thinking was achieved by measuring the quality of the outcome produced. Periodic submission of the work and short quizzes to ensure work is being done helps in assessing if students have been subjected to qualitative critical thinking that is self-monitored and self-corrected. Discussion can be held to clarify some idea, in order to ensure that the students are achieving the expected outcomes.

By reflective exercises on the part of students, structured peer assessment and assignment work that advocates an independent thinking approach can be achieved.

Another respondent wrote, "*The assessment of critical thinking in general is measured by the person it produces in the end. The result measured in terms of outcome rather than output. Classroom learning emphasised the latter more than the earlier. Outcome includes a person who understands his aspirations in life better, in relation to himself, colleagues, family and others. Self-monitoring and self-corrective thinking is vital for a person to achieve higher order of self-awareness leading to a conscious life".*

There will always be a need for assessment, whether formative or summative. However, the methods of assessment should be varied to ensure that learning objectives and standards have been met. As each student is unique, regular one-to-one interaction may provide some insights.

Quality can be assessed from the standard of assignment submission post-intervention. The quality of a student's work produced at the end of self-monitored and self-corrective thinking is indicative of the capability of that student. However, it is inarguable that the difficulty level of the tasks assigned to them for self-learning also contributes to the end product's quality, so setting work at the right level remains paramount.

Through the understanding of the materials, the quality of research work and discoveries presented and by assessing the output/outcome of the given tasks, an insight into quality can be gained. Quality can be assessed through longitudinal observation and documentation.

The complexity of problems solved, solutions provided and the feasibility of the solution provided can be used to assess quality. The quality of self-correction is indicative through the outcome of solutions assessed on use/clarity, accuracy, precision, relevance, depth, breadth, significance, logic and fairness.

We can ask students about their process and findings. Also, quality can be determined through assignments and the practical tasks that the students are able to complete and submit, following self-directed and self-corrected learning sessions.

The measurement of quality is possible only if the majority of the cohort have been trained and developed to a certain extent in this area. If not, it may be found that there is a wide discrepancy in results. It may be difficult to measure quality when maturity levels differ and students differ in their language skills and proficiency.

3.11 How do we ensure that discipline specific knowledge is achieved when an ethos of self-monitoring and self-corrections is adopted?

Much of what we think, left to itself is biased, judgemental and may result in prejudiced 'learning', if an expected outcome is not integrated into the CT curriculum. Respondents were asked in the survey, how they ensure that discipline specific knowledge is achieved when students are left to self-directed learning. The respondents addressed these questions in the light of their own experiences.

Evidence of the acquisition of specific knowledge can be ensured through quizzes, tests, assessments and informal question-answer sessions. Formative assessments are a good method to ensure that the knowledge gained is discipline specific. Continuous monitoring of students' performance in class assessments and discussion, after their self-directed sessions will help to ensure that they are not going astray in the topics that they are learning.

Even before the students start their self-monitored lessons, they must be briefed about the clear learning outcomes and module aims set. It must be established that the learners have understood outcomes and aims clearly. Yet another respondent agreed that, with a clear guideline of topics to be covered and continuous assessments to be conducted on these topics, discipline specific knowledge can be attained in the process of self-directed learning.

Through education, reinforcing the importance of learning is not just for examinations but is part of a life-long journey. Students must be introduced to self-directed learning from a young age and this will get them into the practice of focusing on the areas that need to be learnt, rather than being misdirected or feel lost in the process.

There was a response that stated *"I still believe test results can show this and presentations. It still comes down to knowledge and how comfortable the students feel with what he/she has learnt".* And yet another respondent commented, *"Students learn in different ways. Schools offer an array of packages. Motivational levels differ. Hence, achievement can be recognized if students are able to assess relevant information using abstract ideas to interpret. Also, if they are able to think with open mindedness about alternative solutions and be as objective as possible. Lastly, it is essential to be able to communicate effectively with others to solve complex issues".*

If the above methods are adopted it is necessary to have some sort of evaluation. It can be via oral presentations, papers written and submitted or debates/discussions. This will give an indication of the depth of knowledge achieved.

By engaging with the civic community and industry, organizing competitions, debates, talks and crucially, rewards for same, the acquisition of knowledge can be enhanced.

If the learning objectives can be critically crafted and mapped to objectives, at best we can ensure some level of discipline specific knowledge is transferred or attained via self-monitored and self-corrective thinking. However this is no more than 'scratching the surface' of the benefits that can be achieved from using critical thinking skills.

Regular interaction in groups and with lecturers will provide some indication of how much knowledge the students have acquired. Equally important is the level of participation. In this aspect, it is critical that lecturers practise restraint and facilitate rather than teach. Another interesting respondent wrote,

"*In every one of my classes, I would ask each students to draw up an individual GANTT Chart and SMART (Specific, Measurable, Attainable, Reliable, Timeliness) Goals. This helps them gain their own personal small wins, which would motivate them. I would check their progress against these documents periodically*".

4. Conclusion

The survey has helped in gaining an understanding of the wider inputs from educators who face challenges in implementing critical thinking methodologies in their teaching. The answers to the survey questions have been indicative of learners' attitudes and behaviour towards the reception of methods that may be more demanding. Yet there have been teachers who have been able to positively use strategies that both help in achievement of learning outcomes of the module as well as in grooming students to be critical thinkers with the use of teaching methods that develop CT. There has been a challenge in introducing these strategies, particularly at the lower tertiary levels, where the student cohorts were less interested in learning new ideas, or were uninvolved because of their weakness in language proficiency or academic knowledge. A major reason for this could be that many curricula have emphasized the importance for students in memorizing from books rather than understanding and applying.

Many lecturers, having taught or currently teaching lower levels of tertiary programmes, have expressed a consensus that students were uncooperative in learning through Socratic questioning methods. Conversely, respondents who indicated that they were teaching on higher levels of tertiary programs, have been positive about the response of the students' to CT learning methodologies. The challenge presented by the disparity evident between lower and higher levels must be overcome by educators, who can be reminded about the logical extension that new knowledge can be constructed from existing knowledge. Students from a wide range of cultures, prior educational backgrounds and from different countries, are prone to incomplete understandings, false beliefs and superficial rendition of theoretical concepts. When these disadvantages are brought into the classroom, it becomes a difficult task for the educator to get students to help themselves build new knowledge, but this can still be achieved by embracing their current situation and guiding them to achieve mature understanding.

When it comes to integrating teaching methodologies that encourage CT and conducting lessons by Socratic questioning, group discussions, debating etc., there has been a mixed response from educators. Few of them have been able to succeed with these methods, often because the syllabi coverage did not allow time to be spent in implementing these tools. On the other hand, there have been those who successfully achieved learning outcomes through the use of these tools within stipulated lesson times. Others have not achieved success because a class was made up of students with different intellectual capabilities from very weak to moderate to very able students. This presents a daunting problem for the educator. Weaker students may need a didactic system, while the stronger ones will easily cope with critical thinking methodologies. A more feasible and improved system would be for higher education institutes to include critical thinking methodologies mandatorily in all curricula. Another alternative is for the higher education institutes to adopt an individual module entitled "Critical Thinking" that is delivered in every discipline at lower tertiary levels, in order to inculcate students with critical thinking as they move to higher levels in education.

References

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How People Learn: Brain, Mind, Experience, and School*. *Committee on learning research and educational practice* (Vol. Expanded E). http://doi.org/10.1016/0885-2014(91)90049-J

Chuah, S.-H. (2010). Teaching East-Asian Students: Some Observations | The Economics Network. Retrieved April 18, 2017, from https://www.economicsnetwork.ac.uk/showcase/chuah_international

Constructivism as a Paradigm for Teaching and Learning. (2004). Retrieved from http://www.thirteen.org/edonline/concept2class/constructivism/

Duron, R., Limbach, B., & Waugh, W. (2006). Critical Thinking Framework For Any Discipline. *International Journal of Teaching and Learning in Higher Education*, *17*(2), 160–166. http://doi.org/10.1016/j.nepr.2006.09.004

Elder, L. (2007). Critical Thinking: Where to Begin. Retrieved April 18, 2017, from http://www.criticalthinking.org/pages/critical-thinking-where-to-begin/796

Elder, L., & Paul, R. (2009). The Role of Socratic Questioning in Thinking, Teaching, and Learning. *The Clearing House*, *71*(5), 297–301. http://doi.org/10.1080/00098659809602729

Keele University. (2017). EDU-20028: Reflective Teaching: Critical and reflective approaches to teaching in secondary education. Retrieved April 18, 2017, from https://www.keele.ac.uk/modcat/2016-7/edu-20028.htm

Olson, S. (2013). *Educating Engineers: Preparing 21st Century Leaders in the Context of New Modes of Learning: Summary of a Forum*. http://doi.org/10.17226/18254

Paul, R. W., & Elder, L. (1997). Socratic Teaching. Retrieved April 18, 2017, from http://www.criticalthinking.org/pages/socratic-teaching/507

Plymouth University. (n.d.). SUM:UP - Mathematics and statistics drop-in - Plymouth University. Retrieved April 18, 2017, from https://www.plymouth.ac.uk/student-life/services/learning-gateway/learning-development/sum-up

University College Dublin. (n.d.). Education Theory/Constructivism and Social Constructivism in the Classroom - UCD - CTAG. Retrieved April 19, 2017, from http://www.ucdoer.ie/index.php/Education_Theory/Constructivism_and_Social_Constructivism_in_the_Classroom