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## Chapter 5

# Developing Team Work in IT Education to Foster Student Engagement

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### ABSTRACT

*Teamwork is an important aspect that should be provided by both employers and employees. This chapter proposes relating this ethos to an educational environment in order to foster encouragement among students. Students demonstrating professionalism can provide important discussion points that can help the class environment run more efficiently. When issues arise in a class, students learn not to hesitate in speaking up. Many co-workers fail to work as a team because people do not voice their opinions on certain matters. Learning how to voice that opinion can aid students/employees in progressing an assignment without hindering any other processes. This chapter outlines how to incorporate teamwork into IT educational environments in order to encourage students to engage more with the process. It also gathers information based on student, staff, and industry surveys and strives to highlight the importance of teamwork as a skill essential for IT graduates.*

### INTRODUCTION

One of the most fundamental aspects of computer lab exercises is that students engage with the process of learning new technologies. These new technological skills help aid students in their goal to work in teams. By becoming active members of teams, students learn how to design, plan and build challenging projects and assignments (Fruchter

R, 2001). Working together means the group can reach an understanding of the requirements in a much more efficient and coherent manner. The process of communication means that each group member will learn what part they play in the team and as a result can encourage each other to identify and nurture individual skills (Fruchter R, 2001).

Ever changing technologies are forcing the preservation of competitiveness and as a result are

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forcing higher educational institutions and business analysts to cooperate more effectively. According to their educational, scientific, knowledge-maker and generative characteristics, universities and colleges receive and play a more active role in the development of the economy (Marosi I & Bencsik A, 2010). This in turn implies that colleges and universities need to play a greater role in preparing their graduates for life in industry.

It is important that no single team member takes full responsibility for every task. Everybody must play their part and the knowledge spread among the group (Lerner S, et al. 2009). By doing this, students can engage with the process of 'learning to learn'. Allowing students to determine roles is a crucial part of the learning process which will inevitably lead to greater efficiency in subsequent tasks. It is essential that the promotion of team work activities gets incorporated into the curriculum of an IT related discipline. Lecturers and facilitators often disagree about the direction colleges and universities should take when it comes to delivering modules that incorporate team activities. The majority of teamwork training within IT disciplines focuses in areas of case studies but more emphasis should be placed on developing team strategies to deal with code design and implementation which is more akin to a work environment. Generally all teams are different in terms of membership, group dynamics, and goals yet they go through similar processes as they develop from an immature team into one that is mature and productive (Lerner S, et al. 2009).

How effective a team's work is depends entirely on the internal group processes. In other words, the manner in which conflicts are managed, the amount of trust between members, and the use of an appropriate leadership style, etc (Lerner S, et al. 2009). It is important to note that team members need to be trained in how to work together and taught to understand the professional role and responsibility of each person. There is no "I" in TEAM!

## **BACKGROUND**

In their paper "*What is the Curriculum Development Process?*" Clarke and Stow state that the term curriculum is: "a written plan which drives instruction. It delineates the skills and concepts taught and evaluated to enhance student achievement. Composed of a content area philosophy, strands with definitions, program goals, aligned scope and sequence, learner outcomes, and assessment tools, it is intentionally designed to meet district, state, and national standards." (Clarke N & Stow S, 2006)

Often the issue with developing a curriculum for a module within an IT discipline is that technology is constantly evolving. As a result, a module can become quickly outdated and below standard. Students deserve a module that will teach them about technologies and concepts that are current and relevant to their future careers. Incorporating reflective practice as teaching professionals can greatly help with this common issue. Misguided or redundant concepts can be removed or updated incrementally. This in turn goes some way to developing a curriculum that satisfies the requirements. This review should provide some insights into how developing a curriculum for IT can be problematic and also present some thoughts on how this might be addressed.

It is imperative that teachers and facilitators strategically align programme learning outcomes with module learning outcomes so that students can acquire the technological skills required by both educational establishments as well as by society itself (Fox-Turnbull W & Snape P, 2011). The responsibility for this curriculum falls on the facilitators and governing bodies of particular schools/colleges. With this responsibility comes accountability for the academic well-being of individuals and groups of people (Allen A & Mintrom M, 2010). It is evident that planning a successful educational framework within IT requires certain elements to be addressed effec-

tively. Three strands identified are: technological practice, knowledge and nature (Eames C & Milne L, 2011). With regard to technological practice within an IT discipline, this entails students reviewing relevant case study material and/or implementing this knowledge through practical classes using the relevant software development tools. The technological knowledge itself should be generic and broad. So the students can have knowledge in as many different areas of their discipline as possible. Students should be encouraged to research and develop in areas that are not necessarily taught directly in the curriculum. Finally, the nature strand refers to the students' abilities to relate technology to and differentiate technology from human life (Eames C & Milne L, 2011). This in turn provides students with invaluable skills before entering the workforce such as team work.

Utilising tools such as Articulate can help enhance the learning environment. Articulate embeds itself into PowerPoint and allows a lecturer to develop quizzes, surveys and assessments as well as delivering video, audio and other types of media in a structured environment. The product is ideally suited to users of Blackboard because the interactive material runs within Blackboard. Using environments such as this helps to focus students and encourage interactivity within teams. One of the most common weaknesses identified among lecturing staff is an unwillingness to embrace change, whether that takes the form of adopting a new teaching methodology or adopting some new technologies as teaching aids. Perhaps students should be more actively involved in determining how a module gets delivered.

It is becoming increasingly more desirable to use some new teaching methodologies in order to better promote student motivation and attention. The methodology adopted will be dictated by many factors, including the group size, available time, student characteristics, lecturers' interpretation of a syllabus, etc. (Lacuesta R & Palacios G, 2009) Experience tends to show lecturers that most

students are somewhat reluctant to engage in the process of Team-Work in an educational setting. As a result the process is often disregarded as an educational tool. However informal discussions with 2 local IT related companies have shown that the ability to work in a team is invaluable when it comes to employing a graduate.

Eighty percent of potential employers felt that possessing the ability to work in a team was 'Very Important'. A survey of 28 students (at Letterkenny Institute of Technology) identified several interesting facts. One aspect related to the group process that most concerns students and teachers is the opportunist or parasite behavior of some group members. This problem arises most often in groups composed of four or more people or when the group works outside class hours. One of the ways of preventing this parasite behavior of the students is for the groups to lay down working rules or that the students sign internal contracts (Marin-Garcia J & Mauri J, 2007). When asked the question "Is Team-Work difficult?" the response was surprising.

As a result of the findings it became clear that students found working in teams difficult and awkward. Team work is not something new and therefore the transition from working as a team on a football pitch for example should not be so difficult to translate.

Rather startlingly, 58% of those surveyed had never worked as part of a team in an educational environment. This statistic is an obvious cause for concern and something that should be addressed. In contrast, students obviously felt that working in a team within a college or university was extremely important.

The necessity to adjust the level of participation of the students in the process of learning is increasing. A way to obtain this objective is by redesigning the manner in which the students partake in class. Active learning shifts the focus of content structuring from the teacher to the learner. By being actively involved in the shaping of the content, the learners gain a far better understand-

ing of the information than they would otherwise have (Marin-Garcia J et al, 2009).

It is becoming apparent that industries whose primary focus is on knowledge and technology, are paving the way for economic recovery (Fruchter R, 2001a). Our location globally and the level of the graduates that we produce is now both an institutional and a national strategic issue. Existing in such a competitive environment is making any discrepancies in module learning outcomes more apparent. Lots of more recent institutions were established to focus on local and regional needs, and develop and help “retain an educated manpower in the area” (Fruchter R, 2001a). The Letterkenny Institute of Technology (LYIT) has a significant amount of mature students (over 23 years of age)—a figure of over 30%. These students are incredibly focused and deserve modules that will empower and encourage them to succeed.

For some institutes however, their role was originally viewed as “teaching only” but with a specific commitment to relevant knowledge and applied learning. Some were allowed to undertake limited research activity, but often with an emphasis (only) on development and consultancy. Over time, and commensurate with the global significance of the knowledge society, the commitment to providing “economically useful skills with industrial relevance” and ensuring that “academic activities are aligned with the economic development of their region” has become inextricably bound to offering advanced qualifications and growing research capacity (Fruchter R, 2001a). For this reason alone it is paramount that colleges and universities aim to produce the best possible caliber of student—capable of transferring a skill set easily to the workplace from an educational environment. While all team members should have a clear understanding about the team’s goals and vision, many team members, due to poor communication within the team or lack of communication skills, are not aware of team objectives (Nejati

M et al, 2010). Evidence suggests that software development in an Agile educational setting could be beneficial.

## **AGILE**

Within industry teams collocate because it enhances their ability to communicate. Working in the same room is core to all the agile methodologies (Miller A, 2008). Communication represents a significant part of the effort involved in delivering software, so opening up gateways to communication could increase a team’s overall efficiency (Miller A, 2008). Many agile teams are distributed but almost all agile teams would sit together in a single room with the customer representative or product owner to maximize communication. It is therefore vital to integrate employees who can easily work in a team. More often companies are casting their net wider when looking to hire high quality employees (Miller A, 2008).

Agile Development has proven to be effective at improving the performance of many software development teams. Their productivity has increased and become more predictable and their defect rates have fallen (Grenning J, 2007). Many development processes attempt to take the human element out of software development, but agile’s main focus is about leveraging the people and their interactions. It can be concluded that good people, working in teams who build successful software products. This point is often misconstrued to say that processes do not matter. Processes and discipline do matter, but people matter more (Grenning J, 2007).

Agile teaching is what lecturers often do in seminars and practical classes, where the environment makes it easier to have closer interaction with individual students. It is aimed at eliciting and addressing specific questions that students have, which as a result compliments a more rigid

delivery of material in a conventional classroom environment (Razmov V. & Anderson R.J., 2006). However, not all courses are characterized by inflexibility of structure in the larger classroom. In many project-based courses and software development modules, the emphasis is away from content coverage in lectures, and instead falls heavily on student learning experiences in the process of working on projects or individual software artifacts (Razmov V. & Anderson R.J., 2006). This in turn marks a shift in what instructors can spend class time on, allowing them considerably more time and freedom to engage with the energy of the class – adjusting to student needs and providing advice on the pressing problems students are facing (Razmov V. & Anderson R.J., 2006). Teaching agile methodology can be challenging, but it is a worthwhile task as it enriches students' software development experience (Lu B & DeClue T. 2011). The skills these students learn will be invaluable in the workplace. Agile development can also focus a student in a particular area and as a result can increase skills levels quite significantly. Engaging with the process is paramount though – encouraging a student to do that will lie primarily with the lecturer, especially in the early stages.

Instructors must expect to encounter all personality types in their classrooms. Appealing to each personality type does not necessitate a complete rewrite of a teaching approach, but can help make the class more engaging and memorable for the students (Layman L et al. 2007). The responsibilities of the facilitator are not necessarily the group's leader although this is perfectly acceptable. It is better to think of the facilitator as the person who keeps the group focused on productivity. Therefore the facilitator should focus the team on the task, get participation from all team members, keep the team to its agreed-upon time frame (both short term and long term), suggest alternative procedures when the team is stalled, help team members confront problems and finally, summarize and clarify the team's decisions.

Many courses inherently favor introverts because of the focus on individual study and performance and as a result can isolate extraverts who tend to find their energy by working in groups. Finding an approach that will encourage both personality types is essential when incorporating Team-Work into the curriculum. This is particularly prevalent for computing disciplines. As a lecturer in this discipline, I often find that some of the most intelligent and capable students are quiet and introverted. Working as a software developer or as a project manager will entail working with other people and liaising with people daily. Therefore, incorporating activities that will help instill suitable traits in these graduates is essential.

For the facilitator it might be useful to put a label on the various common issues, which in turn might help to develop a curriculum that can address such issues quickly. (Breslow L, 2005) devised the following:

- **Hogging:** Talking too much.
- **Flogging:** Beating a dead horse.
- **Frogging:** Jumping from topic to topic.
- **Bogging:** Getting stuck on an issue.
- **Dead Buffaloes:** Tiptoeing around a contentious issue.

By labeling such activity, it might be easier to address the issues as they arise—which in itself is a learning exercise in team-work for the group.

## **PROFESSIONAL AND PERSONAL REFLECTION**

In order to achieve a curriculum that will incorporate team activities correctly, it is essential to reflect on current modules so they can be altered correctly. Gauging how other professionals reflect on their day to day work provided some interesting statistics. 15 colleagues at LYIT were asked a series of questions about their reflective practice.



Obviously almost 94% of those surveyed teach in IT related disciplines which make the figures more relevant to subject area.

Reassuringly 94% stated that they do reflect regularly on their teaching. For the one person who did not, hopefully the survey itself might inspire them, as the merits greatly outweigh not partaking in the process.

When asked which areas they reflect most on, it was interesting to see that lectures and laboratory exercises came out on top with only 4% stating that they reflected on in-class discussions. Some of the discussions in class are in themselves a form of reflection. Nuggets of information can be gathered from inter-student conversations or student-lecturer conversations that might inspire a redraft of a particular topic or exercise. Again only 10% reflected on the feedback that they give students. How lecturers relay grades and critiques can have a significant impact on students' confidence and willingness to participate. Reflecting with a goal of making feedback a positive exercise every time, can go a long way in encouraging a student to improve and strive to achieve higher grades.

When teaching professionals discover that they do not or no longer reflect, it is important to work out what factors are involved. The question was asked as to which stumbling blocks prevent reflection. The overwhelming majority (54%) cited time constraints as the number one factor preventing them from carrying out active reflection. PPEs (or Programmatic Reviews) were second with 21%. When timetabling lecturing staff, it might be worth noting, that time should be provided to allow proper module reflection. Meetings and reviews are of course important but they really shouldn't detract from an instructor's ability to carry out their duties professionally and effectively. Facilitating reflection should be considered by management when allocating modules to individuals. Without honing modules, students will inevitably suffer as content will obviously be below par on occasions.

Student engagement is essential if graduates are to be of a certain caliber, therefore reflecting

on one's work goes some way to achieving this goal. Like others lecturers, I believe that reflection should not be a solitary process. The process should include students, colleagues and others (such as industry experts). Without sharing the information, reflection can become a less effective tool. I also believe that we reflect all the time and it is not whether we reflect but how effectively we reflect. What is the aim of reflection? Is it to improve the learning environment? On a practical level, I make use of critical note taking regarding areas that need improvement and portfolios/lab books for each student to monitor their success in certain sections which helps me to keep track of which teaching methodologies they react well to. Of course the students themselves have reacted well this semester to my obvious monitoring of activities. They seemed to genuinely appreciate the fact that I was critiquing my own work in order to give them a better learning experience and that I was willing to change elements as we went along. If we are to incorporate more team activities in our curriculum, then it is essential that the students are encouraged to get involved and give their ideas. After all, it is the students themselves that are doing the work, so they should have activities that they enjoy.

From personal experience, I noted in my diary that we can't assume that the students have previous knowledge in a particular area. Implementing change should be part and parcel of the job as opposed to a chore. Final year students commented to me in my Programming for Security module, that they would like to see more learning options provided by staff. Examples include, lectures, practicals, tutorials, public directory access to notes, VLE/BlackBoard, Articulate, Podcasts, etc. As time wasn't on my side this semester, I decided to change a piece of continuous assessment for this group in order to try and achieve some of the goals they wanted. Therefore, rather than producing a laboratory book, I asked them to surmise the module (including lectures and practicals) into a podcast. The podcast meant that they learnt new



skills and by creating the podcast itself, they carried out revision without even being aware. What was produced could then be posted online and a link added to their Curriculum Vitae, as a means of show-casing their knowledge and skills.

Afterwards, the students commented on the fact that they had learned a lot and found the new assessment method extremely worthwhile and beneficial. Every semester, I look at my notes/handouts and decide if any of the topics would benefit from a Guest Speaker. As I lecture in a Computing Department, it is important that the students get to meet industry representatives. Lots of my content is quite new and therefore topical. Around October time, I noticed the fourth year digital forensic students becoming a little disillusioned. In order to foster encouragement, I organized Guest Speakers (who work in their field of expertise) to come in a talk to all forensic students (from all years). With around 100 digital forensic students together in one room listening to the possibility of working in a very interesting area with a few of them guaranteed to be employed before the end of the academic year, this gave them the drive they needed in order to keep studying and working together.

Again, the students (some of them not my own), commented and emailed me thanking me for providing them with this level of encouragement—proving that sometimes a simple gesture can have a significant impact.

Reflecting on my module content and making note of the fact that I noticed student attitudes becoming negative, meant that I was able to implement a change that helped turn things around without significantly impacting on my workload.

In contrast to my final year students, I also take first year students for Personal and Professional Development. Here the aim is to get the students interacting and getting to know each other through group activities. I noted in my diary early on in the semester that there were quite a few students in

the class with very quiet personalities. It became clear that the proposed approach for the module may not be appropriate in order to include these students. As a result, I devised two new activities that would help the quieter students mingle with the more social students. It appeared to be effective as the “quieter” ones were equally as vocal as their counterparts by the end of the semester. Although it could also be argued that the more introverted students were encouraged by their more social colleagues. Team-work was a major player in this process and reflection was the catalyst for the module changes to be implemented.

One final entry in my diary referred to another group of final year students where I teach Governance for IT Enhancement. It was evident early in the semester that the students were finding the subject extremely theoretical and it became obvious that I needed to inject something more relevant for them. As a result, I divided the students into two groups – the board of directors and IT consultants. The ‘board’ needed to work together to establish their roles and how one depended on the other. The ‘consultants’ needed to work out the hardware and software requirements for the company, compile a presentation and present their findings to the ‘board’. The ‘board’ then had to evaluate the findings and make decisions on whether or not they could progress (given their roles). After initial opposition to the task, the students later commented on how much they had learned and suddenly realized how much effort each team had to put in and where they could have done better. I also made note of some interesting observations with regard to student participation. In order to address the potential issue, I requested that the students compile one group report on the task and each individual also had to submit a mini-report outlining their contribution and what they had learned. When this task was made known to the students, suddenly participation improved greatly.

## **FUTURE RESEARCH DIRECTIONS**

One of the most important aspects in today's organizations is Team-Work as it can increase work performance and result in better outcomes. For any team to be successful, there are key factors which should be addressed, including team members, their attitudes, etc. The research findings show that both desire and require Team-Work to be built into their current curriculum in IT. This is mainly because teamwork should be learned and can be enhanced through education and a proper working environment. Third level education should be concerned with giving its students the ability to learn as opposed to being taught every aspect of every subject. Industry also requires its employees to attain certain standards as undergraduates which will allow them to transfer their skills in to a team environment effortlessly. Colleges and Universities need to align with industry on a much larger scale in order to develop appropriate course content with particular reference to software development.

Larrivee's (Larrivee B, 2008) reference to 'surface' reflection is an important observation. Facilitators often reflect on their work as a means to an end or as a box that needs to be ticked. Reflection should be much deeper than that—plus the value of reflection should be obvious. Without reflection lessons, notes, exams, methodologies would become stagnant and outdated. Setting aside time with classes to ask them how they are coping and if they would to address any issues differently encourages students to be more forthcoming. Being a reflective professional implies that an obvious solution should not be overlooked in favour of a highfalutin approach which often does not address the issue(s) at hand. In a computing department, it is important to students at the end of every semester to fill out a QA questionnaire—in which they should be asked specific questions about courses and their content. It gives students an opportunity to give their opinions which often contain essential pieces of information that can be used for reflection. With the advancements in

technology, it is now more possible than ever to gain information/reflection from others' work via online blogs. Lecturers should make use of these blogs in order to gain better insight into latest technologies/trends and to incorporate this into lesson plans. Kolb's (Kolb D, 1984) model for reflection is accurate, as reflection is certainly an ongoing task that has value and is necessary for teaching to be kept current and informative.

## **CONCLUSION**

Some common weaknesses in teaching include an unwillingness to change, an over reliance on technology, being out of touch with latest techniques, padding out modules with irrelevant material and over assessment. Reflecting on these issues enables a facilitator to better prepare a curriculum in which the student is encouraged to engage with the process. Reflecting about the positive experiences with students allows lecturers to incorporate more of the good aspects into daily activities. As well as equipping the students with subject content to do well in exams, facilitators should ensure that the students have learned something more, for example, respect, working in a team, conflict resolution, becoming confident decision makers and problem solvers and simply making good choices and striving to be the best that they can possibly be. Howard Gardner (Gardner H, 1983) introduces the notion of Multiple Intelligences (MI). Different learners learn in different ways so to that extent there is merit in the theory. Teaching professionals must embrace these diversities and be prepared to adopt modules/lessons/practicals/assessments accordingly. Being in a position to swap and change the lesson content may not always be practical or possible but it certainly is something to consider. It is interesting to note that one student made the observation in the survey "I genuinely believe learning about human psychology can also be extremely helpful in understanding how people work together."

These Multiple Intelligences (MIs) provide a good focus for reflection. Understanding these MI could potentially help to enhance teaching practices and obviously help the students overall. Making use of the entire learning environment in order to keep the students interested—whether that's in class, around the campus, virtually or making use of industry—is extremely important. This might go some way to acknowledging these MIs.

*They create environments which maximise opportunities to learn, in which pupils are well managed and motivated to learn. (Gardner H, 1983).*

As professionals lecturers should strive to achieve this and often do meet the MIs of students incidentally. Students often comment on how introducing a new learning environment instantly revives a topic and often helps them to understand a topic/issue that they previously simply didn't comprehend. By doing so, teaching staff are automatically encouraging students to partake in activities. An effective teacher should remember that while they may have prepared for the class—during the class itself, it is the students that are doing the work—therefore, facilitators should allow them to take ownership of that. It is important to state that colleges and universities have to develop a curriculum for IT which will facilitate their marketability as well as their functionality in the educational and industrial markets. (Tomas M & Castro D, 2011). Using and incorporating Virtual Learning Environments (VLE) into a curriculum can help catapult a previously mundane module into the 21st Century. Within this “virtual reality”, both the facilitator and the students can partake in a variety of curricular and extra-curricular activities (Lawless-Reljic S, 2011). This modern inclusion is a must moving forward when developing a curriculum for IT that is to foster and encourage team work.

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## KEY TERMS AND DEFINITIONS

**Agile Development:** Methodology which is proving to be effective at improving the performance of many software development teams. Their productivity has increased and become more predictable and their defect rates have fallen. Many development processes attempt to take the human element out of software development, but AGILE's main focus is about leveraging the people and their interactions. It can be concluded that good people, working in teams who build successful software products.

**Agile Teaching:** An approach by lecturers in seminars and practical classes, where the environment makes it easier to have closer interaction with individual students. It is aimed at eliciting and addressing specific questions that students have, which as a result compliments a more rigid delivery of material in a conventional classroom environment.

**Articulate:** A tool to enhance the learning environment by embedding itself into PowerPoint

and allows a lecturer to develop quizzes, surveys and assessments as well as delivering video, audio and other types of media in a structured environment. The product is ideally suited to users of Blackboard because the interactive material runs within Blackboard.

**Curriculum:** A written plan which drives instruction. It delineates the skills and concepts taught and evaluated to enhance student achievement. Composed of a content area philosophy, strands with definitions, program goals, aligned scope and sequence, learner outcomes, and assessment tools, it is intentionally designed to meet district, state, and national standards.

**Educational Technology:** Also termed instructional technology, information and communication technology (ICT) in education, EdTech, and learning technology, is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resource.

**E-Learning (or eLearning):** The use of electronic media, educational technology, and information and communication technologies (ICT) in education. E-learning includes numerous types of media that deliver text, audio, images, animation, and streaming video, and includes technology applications and processes such as audio or video tape, satellite TV underlying many e-learning processes.

**Teamwork:** Work done by several associates with each doing a part but all subordinating personal prominence to the efficiency of the whole. In a business setting accounting techniques may be used to provide financial measures of the benefits of teamwork which are useful for justifying the concept.