



## Just in Time Teaching, just in Need Learning!

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### Abstract

*Different approaches to teaching have gone in waves over centuries, two main directions have to some extent been crystalized; lecturing based and project based; an argumentative approach to known knowledge or learning by exploration. Over the last decades a clear shift to the latter has now resulted in a balance between the two, being complimentary instead of opposites. However, new tools and rather large shifts in the way knowledge is obtained or actually consumed, have led to emerging new methods to teaching and learning. This paper will address two of the new trends; just in time teaching and just in need learning. These approaches have been implemented, and tested, in the five year master program in Design at the Oslo school of Architecture and Design, over the last 15 years. However, the findings are relevant for education on all levels. Cues here are; frustration, collective individuality and timing. The teachers role has gone from provider to facilitator and back, but now the teacher design the learning process, giving input at the right time, driven by the decided learning outcome.*

### 1. Introduction and background

The background for this paper is my 23 years of teaching, from primary school and all levels to PhD. The last 21 years have been at an architectural and design school (bachelor and master level) where different approaches and methods for teaching have been developed and tested out. Over the years I have seen that the timing of teaching input has been crucial, some lectures are remembered, some not, what is interesting is; these lectures could be the same, just held at different times. So, clearly there is more to successful learning than the actual quality in the teaching methods. This paper seeks out to identify when teaching input could be most effective, based on experiences.

#### 1.1 Project based and lecture based teaching

Pedagogical methods, approaches, techniques, tools etc. have been developed, discussed, implemented, discarded and reappeared over centuries, if not millennia's [1]. Over the years the classical, lecture based teaching method has been challenged by project or problem based learning (PBL), over the last 30 years the latter has been praised as the future of education [2], however, this has been challenged [3]. Those educational institutions that had a lecture based approach, we now see attempts to shift to the project based approach. Vice versa, schools based on a PBL approach see the need to mix in lectures in their pedagogical philosophy. Adderley et al gave in 1975 a definition of project based learning that is still valid; PBL involve the solution of a problem, it necessitate a variety of educational activities, it ends in an end product (thesis, report, artefact), the work goes on for a longer period, and teachers have advisory roles rather than authoritarian, often through the whole project [4]. The lecture based teaching method still holds its ground, especially within traditional institutions and those with a curriculum not so well fitted for PBL. The success criteria's here is very often solely placed on the teacher/lecturer to contextualise the topic and narrate a story [5]. Some key elements for successful learning have a rather broad consensus [6], one is motivation [7]. Motivating for learning has again been thoroughly investigated and several angles and approaches have been suggested. One approach could be to look at interest and value, two key elements in so called project based learning [8]. Blumenfeld et al based their findings on Malone and Leppers "Making Learning Fun: A Taxonomy of Intrinsic Motivations for Learning" [9] on what could enhance the student interest and perceived value. These factors were; a) variety and novelty, it should contain more than just reproducing known knowledge. b) It should be realistic and have a meaning. c) There should be some kind of challenge. d) There is closure, some kind of natural end to the task. e) There should be more than one way to solve the task, f) Possibility to work with others. [9]

#### 1.2 Teaching versus learning

"Tell me and I will forget it, show me I may remember, involve me and I will understand"  
Aristotle, 384 BC – 322 BC



In "From Teaching to Learning - A New Paradigm in Higher Education" [10] Robert Barr and John Tagg discuss a change in paradigm; from providing instructions to produce learning. There is several reason for this; a faster changing society and the ability to adapt but also the pedagogical methods used; lecture-discussion.[10]. They don't anticipate the end of lecturing, but see it as a tool, not the tool for learning. One challenge with the Learning Paradigm is to incorporate knowledge transfer when and where it is necessary. Even though we all live in a fast changing society, making knowledge obsolete almost before its known [11] there are a tacit knowledge that mainly evolve through doing and we benefit from it almost unconsciously. Some of the teaching goals are to facilitate for tacit learning processes, the motivation to learn increase with the importance of the context [12]. In practice we see that learning for instance a computer program is strongly linked to the context; following a tutorial is almost useless if not motivated to solve a task, even then the tutorial become a teaching platform not a learning platform. As a student you don't find the solutions you seek, but are overwhelmed with knowledge often deemed useless, creating an unfruitful frustration, similar to a boring lecture. If, on the other hand, a specific task has to be solved and the tool to solve it needs to be taught, the ability to withstand frustration is almost proportional with the perception of the importance of the task, or in other words: how motivated you are to solve the task.

As an example; over the last 25 years we have observed how the students in the industrial design department at AHO have learned and developed their Computer Aided Design (CAD) skills. From running tutorials and even teacher led courses we saw that the actual outcome were scarce, however when given a task to solve, preferably their own design, the frustration developing when trying to figure out a way to do things, led to an almost exponential learning curve. Trying different ways to solve the task also meant they were touching several areas that did not solve their problem, but they understood what it could do in a later situation, adding to the tacit knowledge. Frustration combined with motivation could act as a powerful learning agent, opening up for actual teaching if delivered at the correct time, not too early so the teacher solve the problem, but also not too late and the frustration turns into anger. Based on this, one could claim that even a lecture could have high pedagogical outcome if delivered at the right time, when the students need it. There is a window of opportunity for teaching and learning, the task is to know when it appears and exploit it.

## 2. Just in time teaching, just in need learning

Based on the previous chapter we could take a look at an example. Students at the Institute for Design at AHO were given the task to develop a new mouth retractor (used to hold the mouth open when installing dental braces). The product should be injection moulded in plastic and the project had a time frame of 3 weeks. We have over the last 10 years ran more than 30 projects like this and have developed an optimized approach for teaching input and optimized learning. First the task were given, with initial information about the product, for the next three days the students got insight from the net, friends with braces, dentists and also from the company producing todays version of retractors. In this period the teachers role is mainly facilitating, giving advices and being present, the actual learning process is totally driven by the students, no new skills or knowledge were presented/taught. At this stage the students developed their tacit knowledge; analysing, drawing, making models, and using methods learned previously. After 2-3 days previous acquired knowledge have a tendency to run short for solving the new task, the students are now motivated for new methods to be able to come up with solutions. Then, after 4 days they presented three suggestions for a solution, one was chosen and they had two weeks to realise the project, producing a working, producible retractor, using 3D printing. First at this stage they were given a lecture about injection moulding, now they had their design to cater for and the motivation to learn about this highly technical complex production method, which was one of the main goal for this three week project. Next, when digitizing their design, they had some basic skills in digitizing, but they soon understood it was insufficient to actually realise their intended design. This became now a period of frustration, hours of attempting to create the design in the program (SolidWorks) they knew, resulted in either that they succeeded or they were extremely motivated to learn another CAD program more suited to solve their problem. Parallel with all these, lectures in branding, production cost etc. was given, all at a time when the window of motivation was wide open. Towards the end of the project, last two-three days, the window to learn anything is almost closed, it is all about finishing the task and deliver, all students lean heavily on previous projects and how to finalise it, making a presentation, a report etc. Again, this is of course training of the tacit skills/knowledge.



## 2.1 The motivation cycle

If we take a look at the different stages in a project, it is usually five [13] or four [14], depending on how you separate the different phases. If we follow Archibald [14] these four stages are: Conception, definition, execution and the closeout. If we place these stages along a timeline and in the same graph incorporate the level of learning motivation we could detect the window for learning and teaching. Fig 1 shows this attempt, the learning motivation is quantified in low, medium and high. This curve has been developed over 10 years and in more than 30 projects, it will of course differ in strength and position, but we now use it as a tool for planning, not only each project, but also to design whole semesters, ensuring that the decided learning outcome are met.

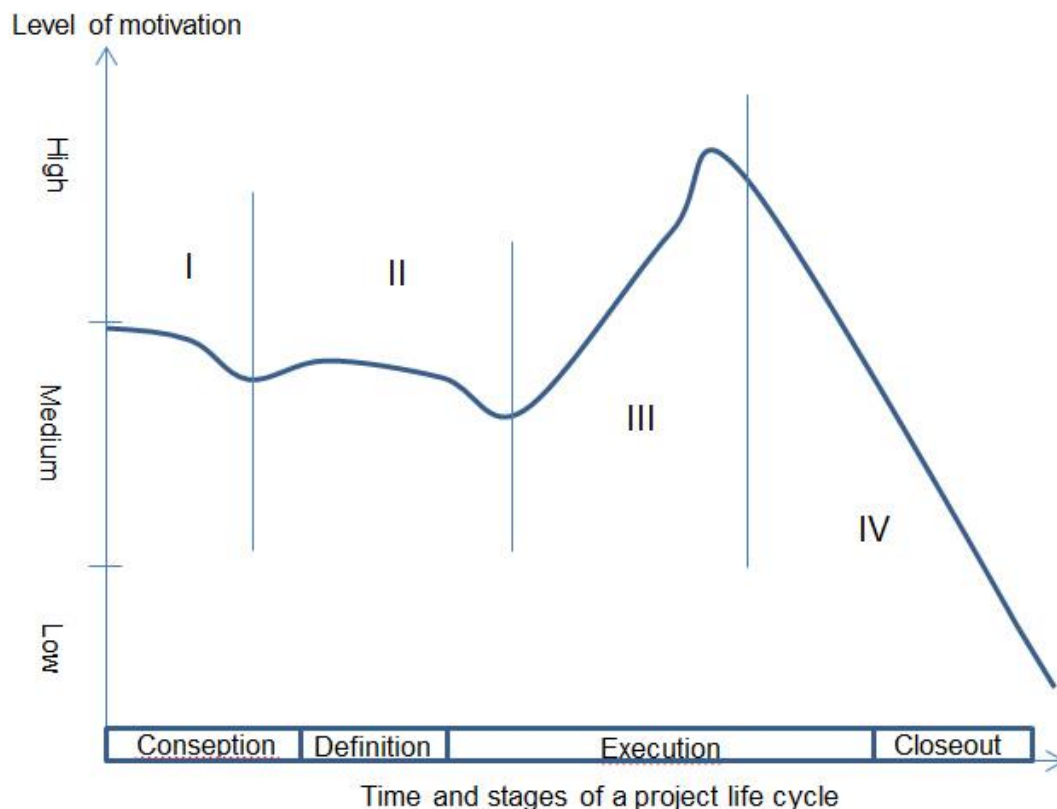


Fig 1 The motivation life cycle, aligned with the project phases

The curve shows four distinct phases (I-IV), not necessarily aligned with the project phases (along the x-axis). The first phase is during start up, the students are usually well motivated when starting up a new project and are eager to learn about the context and boundaries, however, this positive phase has a tendency to lose its power quite fast, a kind of first order fatigue [15] sets in, the amount of information is sometimes overwhelming. According to the example with the mouth retractor, this happened when they discovered how many versions of this product that already existed. When moving into the next phase, there is an imminent need to learn, it could be skills, methods or facts. In the example they were introduced to new methods to handle all the knowledge that's been gathered. Through the Definition phase there is a slow decline in motivation followed by a more distinct dip downwards, this happens in the beginning of the execution phase, here the student start out depending on earlier knowledge/methods to solve (execute) the task. Some time into phase III, there is a steep increase in learning motivation, this is the time the students need to learn new skills, methods or just facts are climbing to its peak, very often leading to a breakthrough and an increased momentum in learning. In the example this occurred when the concept had to be realized, at the lowest cost possible, and then they really needed to know how injection molding worked and what the driving forces for cost are. The needs are at this point well known and understood; it is the best time for teaching. In the final face, IV, when moving into the closeout phase there is a strong decline in the motivation, the student seek to finalize, active teaching is now seen as a disturbance. It is important to understand that developing and increasing the tacit knowledge goes on continuously through the project, but it seems to have a stronger impact when the conscious learning motivation is



lower. In other words, as long as the skills and knowledge already acquired are sufficient, the motivation to learn new things are lower, but at the same time the existing skills are honed and developed. In the example they continued sketching, building mockups and did tests, all things they had learned to do in previous projects.

### 3. Discussion and conclusion

This short paper is of course lacking several discussions around project based learning versus lecture based teaching, however, it is not the intent to neither compare them or criticizing them. The main goal has been to contribute with the experiences made during the last 10 years, which has led to new and more conscious ways of designing the courses. Before starting a course there are some specific learning goals, since there are times during a course the students have an enhanced motivation to learn, the course should be designed in a way that align the teaching input with this time period(s). It is my believe that the approach discussed could be implemented within other educations and for instance in primary school, as stated previously, learning and motivation are strongly connected. From a pedagogical view it's just as important to know when as to know how to give teaching input. A great lecture could be fantastic if it's delivered at the correct time.

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