

Innovation and learning facilitated by play

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Abstract

This paper describes an approach to facilitate interaction between students and industrial companies in a problem based learning environment. The approach is adapted from a methodology developed at the LEGO Company and relies on an improved ability to communicate complex problems when using physical representations.

Keywords: student engagement, industrial involvement, articulating complexity

1. INTRODUCTION

The dominant trend in most educational programs today is to convert traditional classroom teaching to variants of Problem or Project Based Learning (PBL) methods. In most programs the general experience is increased motivation among students and teachers. In some educational programs the projects are focused on real life problems in industrial companies. This particular variant of Project Based Learning is highly challenging for both students and teachers.

When students engage in real life problems in industrial companies the communication issue is a particular challenge. How can students gain insight into the complexity of the company and in the later part of the project how can they efficiently communicate their ideas and solution proposals back to the company.

In this paper we will focus on this specific challenge in conducting PBL with real time industrial involvement: The problems of extracting rich and meaningful insight from the company and reporting rich and meaningful insight back to the company.

The empirical basis of the paper is an Industrial Engineering Masters Program at Aalborg University, Denmark.

2. LEARNING IN PROJECTS – THE CONTEXT

Aalborg University in Aalborg, Denmark was established in 1974 as an experiment within higher education. It is the newest Danish University and started with approximately 900 students. Now, 34 years later there are approximately 13,000 students. The entire university is based on the ideas of PBL.

The Aalborg University model of PBL is designed as a combination of the concepts of PBL and project work [1].

Both PBL and project work are international educational trends, which inspire the development of educational practice at many educational institutions. The ideas of problem-based learning and project work support each other and emphasize different aspects of learning.

The initial German ideas of problem-based learning or experience-based learning were in the beginning of the 1970s transformed into a more or less Danish model of problem-based learning including [2]:

- Problem orientation
- Experience-based learning
- Interdisciplinary

- Gradual specialization
- Project work in groups

The main idea behind both project work and problem-based learning is to emphasize learning instead of teaching. Learning is not like pouring water into a glass; but is an active process of investigation and creation based on the learners interests, curiosity and experience and should result in expanded insight, knowledge and skills. As with more traditional educational systems some of the important questions are:

- How to motivate the students?
- How to determine the elements in the curriculum?
- How to balance the different elements in the curriculum?

The questions listed above are all open-ended. Any educational institution has to deal with these questions and the concern has to be of a continuous nature due to the changes in environment and requirements.

2.1 Challenges of an Industrial Engineering Program

In the Industrial Engineering Program at Aalborg University the questions listed above is challenged continuously by having all student projects conducted in close corporation with industrial companies. The IE program at Aalborg University is a 2.5 year fully project based Master program. During the five semesters the student are working in close corporation with different industrial companies and apply relevant theory on these companies and learn from the process.

According to Lewin in 1945 [3] and later discussed in details by Van de Ven [4] ‘Nothing is quite so practical as a good theory’. Good theory is practical because it advances knowledge in a scientific discipline, guides research toward crucial questions, and enlightens the profession of management. In the Industrial Engineering Masters program the statement encircles a crucial challenge: “How to apply theory on practical industrial problems and thereby improve insight and learning”.

When engaging in complex real life problems at an organizational level within an industrial company the students most often find it difficult to extract insight from companies at the start of their projects and the same problem occurs at the end of the project when the student are to report their gained insight back to the companies. If this problem is solved both the students and the companies will benefit immensely from the projects.

In the past two years we have been engaged in adapting and developing new methods to overcome these issues. This work involves the use of a method developed by the LEGO Company – LEGO SERIOUS PLAY.

3. LEGO SERIOUS PLAY – A SHORT DESCRIPTION

Serious Play combines elements of games within workshops. The process works on the basis of the participants perceiving and visualizing a given organizational problem allowing the individuals to work together to understand and solve the problem.

As an example of a LEGO SERIOUS PAY session, workshop participants build models of their perception of the current state and challenges that their company faces [5]. In this particular case the problem related to different innovation roles of the company. When all participants have built their models (this may be 30 minute sessions) they take turns to explain their models to their colleagues. Participants will typically engage deeply in the stories and will ask questions such as, “Why did you pick a transparent brick to symbolise our marketing campaigns?” The process ensures a much deeper, engaged and lively discussion of the topic at hand. As an example one workshop participant, his model shown in figure 1, explained: “I learn from others, I need stability, so I can look in all directions, my brain is red hot with ideas”.

Another participant explained: “I am an innovation animal that scouts for and eats up opportunities and then spits them out in workshops and brainstorming with my colleagues”. Finally, a product manager commented: “Innovation is an uphill battle, but can be fun. There are hindrances on the way, but they can be overcome when we pull together. All assumptions and prejudices must be put away as illustrated by the blue ball hidden under the model. You will

find yourself on shaky ground now, especially when you are close to reaching the goal. This was illustrated with an elastic band as the last part of the ramp leading to the ultimate goal.”

Almost invariably, participants reported gaining *new insights* into the unit of analysis that the process focused on. People would consistently jump up from their chairs and rove around the room to gain different perspectives on the model as others built and described it. For example, once a five-member team saw their organization laid out on the table in three dimensions, they realized that they had previously held at least four different understandings of their “market”. In another case, participants realized that an important customer service initiative meant very different things to different people in the organization. In such cases, the insights led participants to reconsider the problem that had driven them to engage in serious play in the first place.



Figure 3: An Image of Innovation via “Serious Play”

Participants also consistently reported experiencing *positive emotions* during the sessions than would be typical of a normal meeting of those same individuals. Most commonly, participants exhibited the kind of effective dynamics associated with having fun, as manifested by laughter, smiling, excitement, and unbridled enthusiasm to continue. For example, the HR director of one company drew everyone's attention to his good humor by climbing up onto the table to add a component to the emerging construction. Some participants claimed that they had "never had so much fun" and others made jokes about how they should not "let their colleagues back at the office know how much fun" they had during the process. Beyond the general climate of light-heartedness, participants also consistently expressed higher levels of emotional commitment and acceptance of the serious issues on the table. In several cases, people reported associating positive emotions with the other participants who had shared the experience, and in at least two cases, participants reported feeling better about the organization as a whole because it provided a place for them to engage in serious play. As one participant wrote in a comment sheet, process participants could get "to know each other in a more genuine way" and start "to commit as people, and not as status, role, power, etc."

We have adapted these powerful experiences from internal company workshops to situations where students engage with companies. Before sharing some of our experiences we will shortly discuss some of the theoretical perspectives behind the results.

4. THEORETICAL BACKGROUND

To most people learning and reflection is best facilitated by some kind of physical representation or articulation. Leonard [6] argues that: "The primary activities spawning organizational learning are experimentation and prototyping". This is supported by Argyris and Schön, who introduced the notion of single-loop and double-loop learning where active experimentation is a significant element [7]. The reflective practitioner is in a constant process of thinking, acting, reflecting, and building experience – very much in line with the learning process as described by Kolb [8]. This process is efficient for the professional person but due to the amount of tacit knowledge it is often difficult to articulate and share the results with others [9]. Physical models or other model representations seem to be the most efficient means to facilitate this sharing (and learning) process [10].

Wheelwright and Clark [11] present an empirical based model of the management involvement in product development project (see figure 2). As the model shows, management involvement peaks when prototypes are made. Making the right decisions as early in the process as possible is crucial, and can be facilitated by producing an abundance of prototypes.

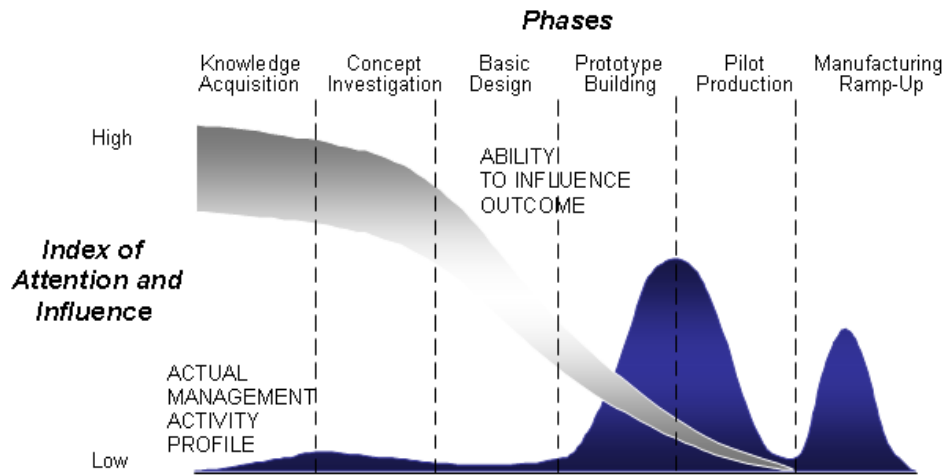


Figure 2: Management's opportunity for and actual exercise of involvement

Though the examples mentioned above apply to different practical setups they all have in common the strong focus on interaction with physical artifacts. This interaction supports articulation and sharing of knowledge. And this again stimulates decisions, actions and learning to take place.

Many contributions and ideas from the fields of psychology and behavioral science support these experiences and empirically documented observations. Our research has drawn particularly from two ideas:

- Constructivism – a theory of knowledge developed by Jean Piaget, his colleagues and his institute in Geneva, Switzerland.
- Constructionism – a theory of learning developed by Seymour Papert and his colleagues at MIT in Cambridge Massachusetts, USA

Piaget discovered that children are not just passive absorbers of experience and information, but active theory builders. Children are not just empty vessels into which we can pour knowledge. Rather, they are theory builders who can construct and rearrange knowledge based on their experiences in the world. His theory of knowledge, stipulating that knowledge is built or constructed by the child is known as constructivism [12].

Seymour Papert was a colleague of Piaget and wanted to extend the theory of constructivism to the fields of learning. Papert eventually called his theory constructionism. It included everything associated with Piaget's constructivism, but went beyond it to assert that constructivist learning happens especially well when people are engaged in constructing something external to themselves [13].

Papert also developed his own and Piaget's ideas to cover not only children learning. It applies to adults as well. Constructionism is a way of making formal, abstract ideas and relationships more concrete, more visual, more tangible, more manipulative, and therefore more readily understandable. At the core of both ideas is the notion that when we "think with objects" or "think through our fingers" we unleash creative energies, modes of thought, and ways of seeing what most adults have forgotten they even possessed.

5. Educational Cases

In the following examples we have described two cases that illustrate how students have been able to engage efficiently with companies and both understand their challenges and communicate their own insight and solutions.

5.1 Case 1

In the first case the students were assigned a task to create a renewed view on company's market. The company – in this article named Alfa – is the developer and manufacturer of sound-equipment for professionals and musicians. Alfa have been an active player on this market in more than three decades with a large product-range and special expertise in digital sound processing.

The LEGO Serious Play workshop was one out of three workshops set up to challenge the Alfa's view on the market. The overall assignment of the workshops was to create a new or alternative understanding of the context in which Alfa will market their future products. In order to make the outcome of the LEGO Serious Play workshop more precise - the focus was narrowed down to consider only digital products targeted at guitarists.

The participants in the workshop were both from inside and outside the Alfa company. Each of them represented a different view on the market, due to their different professional background and insights. The participants included three professional guitarists, a hardware engineer, a software engineer, a philosopher and representative from product management and part-time guitarist, who also worked as a professional sound-tester.

Their educational background indicated a number of bias framings from which they viewed the assignment. And on top of this they also expressed themselves in different professional languages.

An example of this came about in one of the first discussions among the participants. Clearly the attitude towards digital sound was divided in two significant sides. At one extreme were the guitarists, who felt that the analogue sound quality was far better quality than digital sound. And the engineers, who held an opposing view, considered analogue sound much less advanced than digital and therefore not relevant.

Two different framings, which made the guitarist state arguments like: "Real guitarists use analogue sound". Meanwhile the arguments coming from the engineers focused on the technological development. Within the next decade the technological development would enable digital sound to have the same quality as analogues - they said.

The disagreement was left unsolved and the LEGO SERIOUS PLAY workshop was initiated. During the workshop each of the participant were asked to create models, which were related to the guitarist's life and personality – and to present them to the group. By building in LEGO blocks the participants were answering questions concerning the professional guitarists' identity– such as activities, equipment, dreams, fears, challenges and hopes for the future.

The outcome of this workshop was a physical construction of the guitarist's world with many different insights and understandings, some of which until then had remained tacit. For example it became obvious from the workshop that a new type of guitarist was slowly emerging, a type of guitarist, who was more artistic in his approach to music and more experimental in his use of sounds.

Further the construction made it possible to see some connection between different types of insights, and this created some new understandings. It became obvious that the new artistic type of guitarist actually needed and would be interested in using digital sound due to the possibilities like: customization and adjustment that digital could offer in the future.

At the end of the workshop there was a newly found and shared recognition among the participants that it was not about either analogue or digital sound. It was more a matter of finding the right purpose for each of them.

It was discovered that digital sound within the context of the guitarists should be used on its own premises, instead of imitating analogue sound. This meant developing digital sound into a positive alternative or additional choice to analogue sound instead of treating it as a competitor. It should be positioned in a similar fashion to the relationship between the piano and the keyboard.

In conclusion the workshop has been able to provide Alfa with an alternative view of the market in terms of the artistic guitarist and the new role of digital sound – on its own premises.

5.2 Case 2

The company in the second case was an international emergency aid organization and the objective in the workshop was to bring forward insights about the context that could drive the development of a new radical project.

The Danish department of Red Cross were two years ago given the assignment to provide a base-camp in disaster areas, where aid workers could be accommodated during their stay. This type of camp is for situations of emergent disasters like flooding or earthquake – and is a temporary installation lasting maximum six months.

As in the previous case a number of participants, with different levels of experience and different ideas in relation to the assignment took part in a LEGO SERIOUS PLAY workshop with the intention of developing a shared view of their new assignment: the base-camp. The aim was to capture insights about everything from purchasing, storing and packaging the different goods for the camp, to arranging and assembling the camp and also working and living in it in one model.

At the time when the workshop was held, there had already been two situations, where Red Cross in Denmark had to support the deployment of a type of base-camp. These had out of necessity been built on the basis of a civil-defence camp, a process that the Red Cross had inherited.

The participants in the workshop included a nurse, working as a base-camp manager, an emergency coordinator educated in logistics in the military, the emergency chef, an engineer, who had assembled the first two camps, a voluntary aid worker and two industrial design students.



Figure 3: An aspect from one of the sessions held with International Red Cross

In the beginning of the workshop each participant was building different views of the base camp dependant on their understanding or experience with the previous deployment of the camp. For example the nurse was very concerned with the hygienic and the temperature conditions but from a personal point of view. She shared insights about how she often was freezing all night because she did not find it safe to use the burning stove in the tent while sleeping. The engineer was also concerned with the hygienic and the temperature conditions but for him it was more a matter of being able to make the water connections function and have power enough to run the heating or air-condition system.

In the last part of the workshop all the participants were asked to move their insights from the individual level to a shared level by physically building their insights together into the one model. This initially resulted in a crisis, but it soon evolved into a longer discussion and negotiation about the priorities in the camp. Initially the participants found it hard combine the different types of insights but after a number of attempts and through a process of dialog and building the LEGO models were used to experiment with different ideas and options. This meant physically attaching them to each other in different ways and eventually the effort finally paid off.

One of the most significant outcomes of the workshop derived directly from combining the different types of insight and at the end of the workshop the participants agreed to divide the base-camp into different modules. One module

would contain the sleeping area, another the toilet area, another the kitchen area, yet another the working area and so forth. This made it possible to define certain needs according to the different areas, and not generalize solutions throughout the whole camp as had been done in the case of the burning stove. (The burning stove was sufficient for the working and socializing areas but apparently not suitable in the sleeping area.).

The physical division into modules was also able to reframe some of the participant's previous understandings of the camp and their role in making it work. For example the emergency coordinator, who was in charge of buying and storing the camp changed his perspective on delivery, instead of thinking X numbers of tents and Y numbers of stoves, he initiated the idea of storing the camp in units that were equal to the modules. By doing so he could be far more flexible toward different needs and also this type of modular delivery would make it much easier for the aid workers to assemble the camp.

In addition the workshop also gave the participants a shared language. The engineer expressed after the session that he had told the logistic department about his trouble when assembling the camp over and over again, but until now nobody had been able to understand him.

In conclusion the workshop has been able to give Red Cross a shared approach and aim in their efforts to handle this radical new Base-camp project. It was mainly the insight gained through the shared building of knowledge and experience that allowed the module solution to emerge from the workshop. Once the modular solution was discovered it was the ability to gather different insights around the modular concept that made a real difference for the participants.

6. IMPLICATIONS AND PRELIMINARY CONCLUSIONS

Our initial workshops have involved very different companies with relevant problems in an Industrial Engineering context. The first one where an organization wishes to understand if they can view their market from a new or different perspective and the second one where an organization is innovating by working on radical new ways of doing things.

The students have engaged in workshops with two to four selected people from the involved companies. Each workshop lasted less than 4 hours. During the workshops the people from the companies have reported that they were able to tell more than they knew they knew – they were able to reframe their existing knowledge – and they were gaining new insight into the knowledge their colleagues.

One part of the student team was participating directly in the workshop and the other part was observing and documenting the workshop. During the workshop the students were able to propose different solutions and to question deeper into some of the apparent problems or challenges. The workshops created a shared understanding of the particular problem or challenge and it was possible to prioritize future efforts based on this shared understanding. In both cases the students reported significant better commitment and involvement from the companies compared to earlier experiences.

In the second case the workshop was repeated three times during a four month project period. Some company workshops participants changed deliberately during that period. The students reported that the new participants were able to get involved in the problem at hand and to provide new and relevant insight during the 3 hour workshop. The company participants on the other hand reported that they had gained a very good understanding of the ideas provided by the students.

The building Lego Serious Play process (LSP) evokes excitement and emotions that apparently stimulate the communication and perception process of the participants. First of all the LSP application seems to provide a shared language between sometimes unequal groups of participants and the workshops also seemed to enable the participants to make some of their emergent and tacit insights explicit. Secondly there are indications that the workshops made it possible for the participants to combine some of their different insight and perspectives - and thereby create new understandings. Thirdly the workshops imply that the participants were able to reframe their initial understanding and insights into a shared perception of the market or context.

This research is work in progress and it is our intention to continue the research and thereby try to confirm some of the implications that we have identified at this point in time.

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