



## **The Teacher as Catalyst: Skills Development & Self-discovery in Group Contexts**

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### **Abstract**

*Recent reports note that college does not prepare its graduates for the jobs of the future. The need is no longer for technical knowledge and traditional skills but a skill set that will help the transition to a rapidly changing work place. Top skills now include communication and problem solving, and ability to think creatively. These and other capabilities in fact can be developed within the current curriculum through the actions and interactions of the students themselves. Here the teacher functions as a kind of catalyst as he/she introduces small group discussion and group projects as a natural part of the course work. Their role is essentially that of a catalyst, because he/she initially makes the students talk to one another! He/she also provides the groups with provocative questions and problems relating to the common course material, as well as mini-lectures on good group practices. Group work in class might be just a 10-15 minute discussion of a question relating to common class material (preferably controversial), after which each group announces its conclusion, and the teacher takes it forward from there. Other bigger group projects can develop students' presentation skills and their creative imagination. Those projects will also be valuable lessons in team work. As students express themselves, take on different roles, learn from mistakes, and meet new challenges, group work becomes a venue for self-discovery and development of hidden potentials. Also, intercultural and inter-professional communication skills can be developed this way. Alternatively, term-long Interprofessional Projects have been developed to directly address the need for new skills.*

### **1. The Challenge**

There is a current concern about the speed of technical development and the relative lag of training of the work force. Recent reports note that our current educational system does not prepare college graduates for their future jobs. There is a mismatch between what they are learning and what the workplace will require. In technical fields trends are seen as developing so fast that the knowledge obtained in the first year of college will be obsolete at graduation (e.g., The Future of Jobs Report, 2016; What Graduates Need to Succeed, 2017).

Moreover, and perhaps more alarmingly, the critical issue for graduates is no longer the possession of technical knowledge and skills. Those are envisioned as less important than broad basic skills that will help students' transition to a rapidly changing work place. Employers now want their employees to be pre-trained; there will no longer be time for on-the-job training.

What kind of education, then, would be needed to generate the right kind of preparedness so that students can make a smooth transition from school to employment? How can they develop a set of skills and competencies that will enable them to “hit the ground running” in a future environment where workplace training has been eliminated?

## **2. What Do Employers Want?**

What are those coveted skills? For many technical high achievers, it may come as a surprise that the issue at stake for future employers is not technical competence. Instead, the top desired competencies include such things as communication and problem solving skills, and the ability to think creatively—in other words, the current emphasis is on cognitive and social rather than technical qualifications! There is wide agreement about this across industrial fields. Moreover, students are expected to have these capabilities ready at their finger tips! So one natural question arises: Is it possible to address this felt need within the present educational system, or will it only happen through the latter’s total “disruption”, as some forecasters warn?

When employers are talking about communication, what do they actually mean? Do they mean mastery of sophisticated information technology? No, it seems they actually mean good old-fashioned communication. Some employers have particularly emphasized the importance of internal communication in the workplace. What do they have in mind? I believe one problem is that people have taken to emailing each other in the work place even if they could easily visit one another in person, which may increase misunderstandings and delay feedback. Email communication, while it is effective, is not optimal. There are questions that do not get asked, and information that does not get effectively transmitted... Meanwhile those same things might have been handled in face-to-face conversations and been resolved on the spot.

## **3. What Is to Be Done?**

The current knowledge-oriented educational system is clearly not geared up for quick delivery of students with such a demanding set of skills and abilities. But it could be argued that at least part of the needed skills set is being covered at least implicitly. Also, many curricula include internships and practical training, as well as opportunities for “experiential learning” and “service learning”. And outside the classroom, students become active in student organizations, sports, etc. In these and many other ways in the university setting, some of the desired skills and abilities are in fact getting developed.

A short term response to the challenge, therefore, might be to try to make manifest the skills and competencies addressed within the frame of a particular course (for instance, communication, logical reasoning, critical thinking, cultural understanding, ethical reasoning, etc) and explicitly identify how these relate to the desired skill set needed for the future. (This might, incidentally, inspire a radical rethink of the crucial role of the Humanities, which have recently been deemphasized in favor of technical knowledge—which, as we just learnt, has lost some of its status).

However, I have a specific “fix” in mind, as we wait for major educational reform or the envisioned major disruption. I believe we can begin the needed skill building and skill

training within the current system of education by using the wonderful power of our students, starting right now.

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#### **4. Challenging the Industrial Model**

On the last day of the conference, a young French architect raised her hand and noted how ironical it was to talk about the future of education in a lecture hall clearly built to serve an outdated educational philosophy. She was right. We were sitting in an enormous room with inflexible long rows of benches for hundreds of students—as antithetical to developing the desired new skill set as could be imagined.

The current system of education and its spatial setup are connected to an earlier era’s need for a disciplined industrial work force, expected to learn and obey. But over time things have changed—new demand is now for active workers, people that think creatively and critically, and communicate well. This makes our traditional classrooms look as if they actively wished to quench the vitality and initiative expected of the future work force. But we can overcome this obstacle by helping the students develop those precious new skills and capabilities and bring in the power of the students themselves. Chaos in the classroom! shouts an ancient disciplinarian from the woodwork. Not necessarily, we answer—let’s just call it “organized spontaneity” instead...

One thing that we will be doing is re-emphasizing face-to-face conversation. This, in fact, is a quite serious issue. Recently, the speed and accessibility of electronic media have been challenging this important mode of communication, with all the valuable nonverbal cues and instant feedback it enables. Sherry Turkle in her book *Reclaiming Conversation: The Power of Talk in a Digital Age* (2015) makes a number of good points warning us about the various pressures put on us by the electronic media in our lives and work. For instance, multitasking sounds great but does not really work as believed. Meanwhile, under the pressure to do things faster, we may lose our important capability for deep reading and understanding. There is now increasing research on the actual addictiveness of social media, and special treatment programs for cell phone addicted youngsters.

#### **5. Empowering Students**

Students need to be put more in charge and given room for experimentation and reflection. And there should be plenty of room for making mistakes, as Nora Bateson revealed in her lecture at this conference, her father’s notion of “learning to learn” actually had to do with our willingness to learn from our mistakes. (“Learning to learn” was titillatingly metaphysical-sounding to me when I read Gregory Bateson’s famous *Steps to an Ecology of Mind* as a student of communication, Bateson, 1985).

The first important thing is to get students to talk to one other! It is surprising how little contact students in the same class may have outside the classroom. This is a terrible waste of opportunity. I reason that students in general would like to talk with each other, but since they don't know each other they do not, and the result is a sea of disconnected individuals. But this is where the teacher comes in—she/he can arrange for students to formally “meet”, quite legitimately, around small group tasks! It only takes asking students to form small groups in class to discuss some chosen question. It may surprise the students but they will do it, and that is the beginning of a new life in class. This should be done early in the semester and it is also good to assign early homework projects that involve group collaboration outside class. The idea is for the whole class to eventually get acquainted through participating in various group activities.

Being part of a small group will help students overcome the inhibitions that otherwise prevent them from speaking in class. Speaking in class is quite terrifying for many, which is understandable, but this inhibition will just have to be overcome, the sooner the better, and the teacher can facilitate this by forming groups. It is more natural and less scary to open one's mouth in a small group. The larger aim of course is to build a class climate where every student will *want* to participate.

The sheer presence of people that one feels one can count on can make a great difference. My ambition to get students to know each other aligns directly with the important research cited by Stefan Brunnhuber in his presentation at this conference: much of student success and retention can be shown to be directly dependent on extracurricular factors! And here one of the most important factors turned out to be having a friend in the class.

The next step, then, is to use the small group idea to develop those much desired skills of communication, problem solving, creativity, and other capabilities within the framework of the existing curriculum. I see this happening through the actions and interactions of the students themselves, as the teacher makes small group discussions and group projects a natural part of the course work. It is not necessary to sacrifice a lot of precious class time, but group work has to become a regular feature of the class work.

Those early group discussions might be just a 10 minute discussion of a question relating to the class material (a video, reading, etc). Then someone in each group reports the group's conclusion to the class as a whole, and this in turn gives the teacher material for a quick comparison and possible general class discussion. Topics that are emotionally engaging or involve moral judgment tend to particularly activate the class and encourage even shy students to speak up.

Apropos speaking up, there is a lot of background noise in some class rooms, and students tend to mumble or not realize that they have to speak louder or project their voice in a class room setting. Speaking clearly is another thing the students also must learn. I have in fact taken to just telling mumbling students to speak up so that their class mates can hear them. Paying attention to the sound of one's voice is very important and a transferable skill. Meanwhile it benefits the whole class—and me.

## 6. Developing Skills through Group Work

In addition to ad hoc groups for discussing certain issues during lectures, there can be

group projects of a more long-term kind. For instance, in a class for architects I have them identify and analyze a particular thematic environment using concepts from our class. They are then to recreate the particular environment and experience for us in a class presentation (how do you best convey the spirit of the Rainforest Café?). In another class, students form interest groups around various emerging technologies, preparing final presentations about each technology's technical feasibility and potential social impact. Projects like this develop students' analytical and presentation skills as well as their creative imagination, and they gain experience of cooperative learning and work.

At the same time, such bigger projects are naturally also exercises in team work. But students need to know that team work is something that has to be learnt. So here the teacher needs to give a timely mini lecture about the basic idea of team work and team leadership, while letting the students decide about their own teamwork rules and division of labor. She/he may also now take the opportunity to warn about typical problems with group work, such as the infamous "group think" and the ubiquitous "free rider phenomenon", maybe inviting a discussion about potential remedies.

More permanent groups might also try their hand at available techniques for idea production, decision making, and problem solving. Also, if time allows, trying out techniques and tools for creativity may become another part of the group work, as may some tools for group self-analysis. All this familiarizes the students with group work (and its problems), and they will be able to refer to their various experiences and training of particular group working skills in their job resumes. (One such skill is listening!)

## **7. How Groups Can Help Students' Self-Discovery**

Group work and team work may also be venues for self-discovery and development of hidden potentials, as students take on various roles, meet new challenges, and reflect on their experience. The thing to remember is that college students are still growing, both physically and mentally, and under our eyes. They need to be exposed to different environments and experiences to find out more about themselves and how they respond.

A good case is a female student who discovered that she loved doing research and that she had natural leading abilities. This insight came to directly impact her future career choice. Another very quiet student found herself becoming the leader of a group of males in a project on the feasibility of human exoskeletons. Other students have surprised me with their great class presentations—their passion for the subject matter can turn quiet students into eloquent speakers.

A good example of discovering new capabilities in oneself is a group project involving educational geography and astronomy games for middle-school students. (This was part of a social communication class). At one point the middle school students visited our class to test the games and give our project groups critical feedback. Here I saw a completely new side of my male students: they turned out to be surprisingly good at interacting with their young "customers", patiently explaining their games to them, eliciting feedback and accepting criticism.

Small group discussion is also an excellent way to dealing with values—not least making clear one's values to one self. I often ask students for their moral and ethical judgment of the

behavior of scientists—say, of Jim Watson as he depicts himself in his book *The Double Helix* (Watson, 1980), compared to others' description of him, and last but not least, in relationship to the established norms of science. Students are interested in judging people's motives, values, and behavior, and intense discussions often ensue. Challenged by others, students have to figure out why they take a particular stance on an issue.

My paper so far has discussed how skills training and self-discovery may be started already within the framework of the existing curriculum, and I have suggested the strategic use of discussion groups and group projects for achieving this goal. An advanced option would be to include in the curriculum whole courses devoted exclusively to project based learning and the development of a certain skill set.

This is exactly the idea of the existing IPRO requirement at Illinois Tech. In order to graduate, every student must have taken two of these IPROs, first a “practice” one, explicitly designed to acquaint students with various existing methods and techniques, and the other, a “real” IPRO, which involves identifying a suitable project, solving problems as they arise, and perhaps coming up with a patentable idea. A “real world” touch comes from the fact that the second IPRO typically involves sponsorship and involvement from some company. The point of these projects is for the faculty member to give the students as much initiative as possible, acting more as a facilitator, resource person, and “remote controller” than a project manager. Meanwhile, concrete advice about such things as model building and prototyping can be obtained by an adviser in the university's Idea Shop. The projects are then exhibited, presented and assessed by judges on the yearly IPRO Day.

## 8. The Teacher as Catalyst

I think the teacher is best described as a catalyst—her/his sheer presence causes things to happen. A catalyst makes things happen that might not otherwise come about—students in class actually talking to each other, actively discussing course material, and collaborating on group presentations. They function as a catalyst, because she/he makes the students initially talk to one another in a small group setting, provides suitable discussion questions for their discussion, as well as mini lectures regarding good group practices and avoidable dangers. But the teacher also has other roles—especially as someone who encourages students, introduces them to a world of values, opens up new theories and results for them to consider, and provides them with suitable challenges. The teacher is on the students' side, working with them as they develop and find themselves and their strength. A personal goal for each student might be to find the conditions for the particular state called “flow”. Experiencing flow means being so intensely immersed in a task or activity that one forgets time and space. This requires a challenge that is not too difficult and not too easy, but just right (Csikszentmihalyi, 2009). Some students have reported feeling flow when doing homework in computer science or architectural drawing, others in running, playing instruments, or dancing. Mere listening to others' descriptions already broadens the imagination—and connects the students to each other.

In this essay I have been arguing for the introduction of various group experiments and for making project based learning part of the overall university education. Team-based project-based learning can in principle result in a win-win situation for both the students and the “client”. Prototypes may be further developed, and models and procedures transferred

to other contexts. The overall pedagogical challenge is to structure the projects in the right way to bring out and nurture the students' natural enthusiasm and creativity and help nurture an attitude that welcomes learning new things. Such team projects teach not only "learning by doing" but also problem-solving through cooperation with people of different backgrounds, interests and skills. Such projects need to become an important part of education and receive appropriate academic credit, since they are the tickets to the future.

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*"Teaching is an ongoing research process."*

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What, then, about traditional "academic" type knowledge? There is a good amount of extremely useful "real world knowledge" which is, alas, not part of the academic core curriculum. I refer largely to knowledge from social psychology and interpersonal communication. For instance, most individuals are unaware that our minds are not neutral but biased in various well-known ways, that situational factors and group phenomena may change our individual judgment under certain conditions, and that good group decision-making (just as good team work) is an achievement rather than a given. Meanwhile, differences in cultural expectations, conversational style, and non-verbal behavior easily give rise to misunderstandings. Knowledge of this at an early age can improve the quality of life (and make lives for the Machiavellians of this world more difficult).

Useful knowledge of this kind needs to be incorporated as a matter of course in the curriculum. In this way schools should help provide a realistic context for students to find their individual strengths and interests and develop their inner potential.

## **9. Steps to an Ecology of Education**

After the presentation of my paper at the Rome conference, one lady in the audience asked where I have learnt my teaching style. As I explained to her, I believe my own training as a teacher comes primarily from having worked as a teaching assistant in 11 different undergraduate courses as a graduate student at Harvard, including history and literature, experimental psychology, history of science, and non-verbal communication. All fascinating topics, which I was learning all by myself while leading the weekly discussions in batches of 20 students (I describe this in Gullette, 1984). Getting students to talk led me to develop a kind of Socratic method which involved in principle every student. Later at Illinois Tech I developed my own courses addressing among other things how science is actually done and how regular people experience architecture... I was aiming for a "learning-by-doing" or "learning-by-experiencing" approach, while challenging students to come up with creative solutions. The TA training seminars by legendary Professor Christensen at Harvard Business School had already convinced me of the pedagogical power of good case studies, and I naturally came to emphasize what Janani Harish calls "contextual knowledge" (Harish, 2015).

Finally, I should probably mention that I regard myself as an educational experimentalist—for me teaching is an ongoing research process. This essay is largely a report of actual experiments that I have tried. Has there been any success?

Of course American students are great in sports and in that they never complain that something is undoable—they just do it. But my system has worked also with Swedish

speaking students at Abo Akademi University in Turku, Finland, and Swiss students at ETH in Zurich. But where did I get the idea of using slight provocation, challenge and surprise? I track that back to my friendly high school math teacher who did things like hinting at a “trick” in problem number 3—which immediately turned solving it into a sport in our class. I believe I am continuing this tradition of seeing learning and discovery as adventures as they did. The real adventurers, however, are the students, and we teachers will do well to serve as their tour guides and facilitators, hoping to catalyze amazing developments.

I regard myself as participating in the unfolding of the capabilities of our students, hoping that my encouragement and attempts to “catalyze” are bringing results. Meanwhile I see as a positive sign the feedback I got from my university last year in the form of the Trustees Outstanding Undergraduate Teaching Award.

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