



VRIJE
UNIVERSITEIT
BRUSSEL

ACTIVE LEARNING CENTER

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Abstract

A traditional classroom, with an instructor as a facilitator of learning, is designed for students' to passively receive information. By contrast, an active learning classroom encourages active, collaborative, student-oriented learning, and as such contributes to students' overall academic achievement. Although the advantages of an active learning classroom are dominant over the traditional classroom, the shift from traditional to active has been very slow. This is calling for the development of an active learning center at Vrije Universiteit Brussel to nurture students' critical and analytical skills and to encourage self-directed learning. We designed four different classrooms: An Active Learning Classroom, a Hybrid Active Learning Classroom, a Flexible Active Learning Classroom, and an Informal Active Learning Classroom. After reviewing the literature, we proposed the most optimal way to fill the classrooms, with furniture and technology that support students' engagement and collaboration. Active learning pedagogies are constructivist-oriented pedagogies that emphasize that students actively construct their own knowledge. As reflected in this paper, the concept of constructivist leadership theory is based on the same ideas that underlie constructivist learning. We believe that universities can achieve successful educational change by developing physical learning spaces aligned with proper active learning pedagogies and technology.

Key Words/Tags: active learning, physical learning environment, constructivism, pedagogy, high-technology classroom

Table of Contents

Abstract	2
Part I. Research on the Challenge	4
Focus and Background	4
Traditional versus active learning classroom	4
Physical space	5
Pedagogy	6
Technology	7
Current approaches and challenges	7
Part II. Design Thinking Process.....	8
II-A. Documenting the Design Thinking Process	8
II-B. Stakeholdership	10
II-C. Mindsets, Methods, Extremes and Mainstreams	12
II-D. Essential and Crazy, What-if Questions	14
Essential questions.....	14
Crazy questions:	14
II-E. Solution: Prototype (Vision Only).....	15
Active Learning Classroom	15
Hybrid Active Learning Classroom	16
Flexible Active Learning Classroom	17
Informal Active Learning Classroom.....	18
II-F Accounting for Bias	20
Part III. SMART Metrics Selling Your Idea	21
Is it SMART?	21
Is it Sellable?	24
Part IV. Reflections on Educational Change	27
Leadership Theory.....	27
Constructivist learning theory behind Active learning.....	28
Educational Change Reflections	31
Part V. Appendices.....	33
Appendix V-1: References	33
Appendix V-2: Management Design and Structure.....	40
Appendix V-3: Budget.....	42

Part I. Research on the Challenge

Focus and Background

Active learning is defined as any instructional activity that encourages students to actively construct their knowledge (Carr, Palmer, & Hagel, 2015). According to Bonwell and Eison (1991), to be actively involved, “students must engage in such higher-order thinking tasks as analysis, synthesis, and evaluation” (p. 5). Compared to the traditional classroom where students primarily listen, in an active learning classroom students also “read, write, discuss, or engage in solving problems” (Bonwell & Eison, 1991). Evidence suggests that students in active learning classrooms have higher test scores and are less likely to fail exams than their peers in traditional classrooms (Freeman et al., 2014). However, the shift from a traditional to an active learning classroom still faces challenges. Traditional classrooms stubbornly persist, likely due to cultural barriers (Christersson & Staaf, 2019). Given the large potential benefits of active learning, universities should take responsibility in carrying out this important educational change.

The goal of this paper is to create an active learning center at Vrije Universiteit Brussel. To achieve high-quality education, it is important to align three main elements: physical space, technology and pedagogy (van Merriënboer, McKenney, Cullinan, & Heuer, 2017). In this paper, we will first introduce each of these elements separately and explain their significance for developing active learning classrooms. Further, we will design four active learning classrooms by properly connecting these elements to fully utilize the benefits of active learning. Lastly, we will suggest how the introduction of an active learning classroom can be a part of educational change to achieve sustainable development.

Traditional versus active learning classroom

The traditional classroom is designed for students to passively receive information from the instructor, whereas in an active learning classroom, students are nurtured to develop higher order skills such as critical thinking, analytical thinking, metacognition and others. Instructors in a traditional classroom have the primary role, and this approach is known as instructor-centered. Instead of being the facilitators of learning, instructors should rather be providers of knowledge (Christersson & Staaf, 2019). Based on constructivist learning theory, in student-centered learning, a learner is “an active constructor of knowledge based on previous experience, perceptions and knowledge” (Lewis, Chen, & Relan, 2018, p.1). Student-centered learning is found to encourage independent thinking, students’ autonomy and motivation (Ahmadi, 2018).

Extensive evidence across educational disciplines indicates that active learning classrooms are dominant over traditional learning classrooms when comparing students’ test scores, failure rates, critical thinking motivation and overall academic performance (Freeman et al., 2014; Mueller, Knobloch, & Orvis, 2015; Nelson & Crow, 2014; Shieh, 2012). However, the traditional design of classrooms across schools and universities still did not shift to a more optimal active learning

design. For instance, tables in traditional classrooms are still organized in rows, with the instructor having primary role. In this way, there is no balance of power, but rather the whole power is on the instructor. A meta-analysis conducted by Freeman et al.'s (2014) provided an important contribution to the field of education. Specifically, they examined 225 studies, and found that test scores of students in active learning classrooms increased by 6% compared to students in traditional classrooms. Additionally, students in traditional classrooms were 1,5 times more likely to fail their exams than their peers from active learning classrooms.

Physical space

The learning environment has been found to influence students' learning. As Guardino & Fullerton (2010) argued, "modifications to the classroom environment increased academic engagement and decreased disruptive behavior" (p. 13). The flexible design of the classroom is found to be beneficial because it is easier to anticipate changes of educational goals and educational programs that are reflected in organizational strategies (Muñoz Cantero, García Mira, & López-Chao, 2016). Space should always be adapted to students' and instructors' needs. This means that active learning classrooms should be equipped with flexible furniture that allows a more positive classroom environment for all.

The seating arrangement is one of the important issues in the classroom, given that it is found to have an effect on "self-esteem, achievement, motivation, tendency to verbalize, and possibly intelligence" (Montello, 1988). For instance, some studies found that the level of students' participation and attention to learning activities is likely to be higher for students who are assigned to the front row and the center of each row than for other seating arrangements (H. H. Choi, van Merriënboer, & Paas, 2014). Stires (1980) found that "seating location affected attendance, grades, attitude toward the course" (p. 363). Because of these findings, it is desirable to modify the traditional learning environment and to introduce more effective seating arrangements. Additionally, environmental factors such as lighting, acoustics and temperature should be taken into account while designing active learning classrooms (Muñoz Cantero et al., 2016).

Research indicates that classrooms should foster group activities, engagement and collaboration between students. To achieve this, it is crucial to fill the classroom with the proper furniture. Tables should be designed in a way that enables group integration – round, rectangular, lozenge or octagonal shapes are the most optimal (Painter et al., 2013). Given that flexibility is very important, chairs, tables and whiteboards with wheels are useful to facilitate students' movement. Tables should be supported with screens and other technology (Painter et al., 2013). Montessori (2011) argued that students should be allowed to stand at their desks to increase attentiveness. Thus, it would be useful to have sit-stand tables in the classroom. Node chairs are also useful to have in an active learning classroom, given that they are "designed for quick, easy transitions in the classroom, and to support learning modes across the campus" (Steelcase, 2020). As mentioned in the literature, "whiteboards can be used as an external cognitive processor to collect

and share the knowledge collaborative learning” (H.-H. Choi, Van Merriënboer, & Paas, 1994, p. 230). Additionally, the movable and interactive whiteboards can provide an even more proper collaboration within and between groups.

Pedagogy

When pedagogies are not properly connected with physical space and technology, the quality of the learning process may be reduced (van Merriënboer et al., 2017). In order to fully utilize the benefits of active learning, static furniture should be avoided, and physical space should support pedagogies and technology in the classroom. As Chiu and Cheng (2017) mentioned, active learning pedagogies can work efficiently even in a traditional setting with a fixed seat setting. However, the most optimal way to connect active learning pedagogies with space is to design a flexible active space to foster group activities and achieve higher order thinking. Ertmer and Ottenbreit-Leftwich (2013) mentioned how important it is to have a pedagogy-driven approach while integrating technology in the classroom.

Active learning pedagogies are based on constructivism theory, and tend to apply theory into practice (Cattaneo, 2017). As founders of constructivism argued “education should be about learning not teaching; learning as in a place where individuals construct their own knowledge personally and socially” (Cattaneo, 2017, p. 145). There are many modern pedagogies that can be classified as active learning pedagogies: project-based, task-centered, competency-based, team-based, problem-based, discovery-based, inquiry-based, and case-based learning (Cattaneo, 2017; van Merriënboer et al., 2017). As they are based on constructivism, they focus on student-centeredness, collaboration, process and content, and students’ reflection and motivation (Cattaneo, 2017). Cattaneo (2017) argued that students in active classrooms are encouraged to “build on prior knowledge, think critically, reflect and present their information independently and in small groups” (p. 146).

Literature suggests that active learning pedagogies increase student engagement, knowledge transfer between disciplines (Norman & Schmidt, 1992) and long-term memory retention (Hmelo-Silver, Duncan, & Chinn, 2007). As Cattaneo (2017) mentioned, “effective inquiry-based learning encourages student curiosity, makes inquiry visible, emphasizes the importance of topics and questions, facilitates the process of gathering and presenting information, and integrates technology”. (p. 147). As Foran (2001) argued regarding case-based learning, students “develop critical thinking skills, learning through decision-making and role-playing situations, increasing confidence in defining, confronting, analyzing, and solving problems through interactive discussions, and exercising and developing skills in public speaking and group problem solving” (p. 45).

Technology

As Bojinova and Oigara (2011) mentioned, technology in an active learning classroom is likely to increase overall engagement, performance, and learning. The study by Park, Choi, Park, and Choi (2014) also argued that students' perception about learning experience improved when participated in a technology-based active learning classroom compared to a traditional classroom. Technology in an active learning classroom is also found to improve students' critical thinking skills and to lead to enhanced higher order learning (Crouch & Mazur, 2001).

Although technology in combination with active learning pedagogies and proper physical space is found to be crucial for students' academic achievement and satisfaction, it is challenging to facilitate them for large classes with hundreds of students. Given that students' activity and engagement are found to improve learning and critical thinking, a solution is desired. The research proposes clickers as a successful strategy to enable collaborative and active learning in large classrooms (Bojinova & Oigara, 2011; Green & Repetti, 2015; Hunsu, Adesope, & Bayly, 2016; Shapiro et al., 2017). Hunsu et al. (2016) defined clickers as "transmitter-receiver system comprising of a handheld device, clicker, and a computer software program that receives signals from the handheld device" (p. 103). In this way, an interaction between the instructor and the entire class can be provided.

Current approaches and challenges

The space in which traditional lectures are taking place is very similar to the space used by medieval universities (Park et al., 2014). This traditional setting is has become rather obsolete, and new modern settings are desirable. In the 21st century, the technology era is spreading in all aspects of people's lives, and also in educational settings. Given the changes in space and introduction of technology into the classroom it is necessary to connect them with modern pedagogies. However, universities face challenges such as cultural barriers and limited budgets (Christersson & Staaf, 2019) to replace traditional classrooms and entirely switch to a more optimal active learning classroom.

Nowadays, there are numerous examples of active learning classrooms across the world. For instance, North Carolina State University in the USA developed a space called SCALE-UP that stands for "Student-Centered Active Learning Environment with Upside-Down Pedagogies." This university collected data of almost 16,000 traditional and SCALE-UP students taking physics. They conducted a study that found that students in SCALE-UP classrooms "significantly increased conceptual understanding, improved attitudes, successful problem solving, and higher success rates, particularly for females and minorities" (Beichner et al., 2007). The university of Minnesota also examined differences in students' outcomes for active and traditional learning. They found that active learning space enabled students to outperform grade expectations, to improve student perceptions of the learning experience, and to change instructors' classroom behavior. (Walker, 2009)

As encouraged by the constructivist approach, students and instructors should consider learning as a continuous, life-long process. "Active learning can provide a valuable contribution to implementing a cooperative institutional vision of learning and teaching in higher education, which educates active, well-educated, well-rounded and responsible, global citizens" (Christersson & Staaf, 2019, p. 4). Universities have a crucial role to redefine learning and ensure the goals of "the development of students into active citizens with global engagement as well as towards ensuring the involvement of all higher education stakeholders" (Christersson & Staaf, 2019, p. 8). Active learning classrooms can help universities achieve these goals.

Part II. Design Thinking Process

II-A. Documenting the Design Thinking Process

This project is a human-centered design, which is encouraged by people and it evolves into creating abilities and recognizing patterns. This type of design process happens in natural settings with emphatic, collaborative and optimistic attributes.

The Design Thinking Process starts with clarifying the design challenge questions we would like to address.

1. Product Design: How might we design a space that facilitates active, collaborative and student-centered learning? Which technologies can serve our goal? How can this space maximize the engagement and wellbeing of students?
2. Spaces: We know there are 4 classrooms to design of about 240 m². How might we design each classroom considering we don't have detailed information of the space? How might we design a prototype without having been in the classrooms we are supposed to design (VUB)? How might we design spaces that allow for more interactions between individuals, groups and instructors than traditional classrooms? How might we design spaces that can encourage instructors to experiment new learning practices gradually and comfortably?
3. Services: How might we prove that the ALC is beneficial for students? How might we know if students and instructors prefer new learning strategies to traditional ones?
4. Systems: How might we design classrooms for instructors and students who have limited knowledge of active learning strategies? How might we design classrooms that can enhance the reputation of VUB and encourage more students to come?

The second phase consists of discovering and sincerely understanding our stakeholders necessities and their context, while gathering inspiration.

We have done extensive research on the topic and looked at some previous examples from other universities to inspire ourselves and to take into account the advantages and drawbacks from these ALC. After that we searched for inspiration from the people we design for. Unfortunately, we could not observe and conduct research in locus but we created surveys for students and

instructors from the VUB to understand their needs, desires, and opinions to know how these innovations would fit them. Empathy is the premise of the Human-centered design and not only brings us close to their perspective, but stimulates us to think of new possibilities, limiting at the same time our preconceptions and cognitive biases (Ideo.com, n.d.).

We started doing the surveys on 29.11.2020 and on 11.12.2020 we started sending the surveys to the students and professors from VUB and outside VUB. We posted the surveys for students on VUB groups on Facebook and on WhatsApp groups. Surveys for professors of the VUB and outside the VUB were sent by email.

From the responses of the surveys, we discovered that students are motivated to learn in an active and collaborative environment, would like to study both in groups and individually, and would like to have a peer tutoring center. Professors, on the other hand, are willing to have flexible spaces where it is possible to combine and move gradually from traditional to newer teaching strategies. The needs of the sponsor, which is the VUB, are to continue with innovation and technological advancement and the Faculty of Education Sciences should be at the forefront of being in line with the educational principles they provide.

Moreover, the surveys gave us an overall view of which technologies students and instructors would like to use, the furniture options they are more comfortable with and which desires and fears they have.

The third phase of the Design Thinking Process is the ideation. In this phase we made sense of all the information and inspiration we gathered through research, surveys and our discussions.

After a careful analysis of the responses from surveys, we had and we started to think as a group of possible solutions that could best address users' needs and desires. We had very positive responses from the surveys, which motivated us in the process since both students and instructors expressed a desire to have these classrooms in their Faculty. On the other hand, because almost all the spaces, technology and furniture we proposed received a high consensus, we had more freedom to decide, enhancing simultaneously the possibilities. Therefore, it took some time to make choices and set the direction of our future design solution.

During our brainstorming sessions through "Zoom", we discussed our perspectives and ideas, while sharing "Google Documents", helped us to quickly and efficiently communicate between our meetings and be up to date with the project. In this phase we made sketches and notes, sharing many different possible design solutions of interactive and flexible learning environments that enhance an active and collaborative pedagogy. Moreover, we had to take into account the budget and time we had available.

The ideate phase was the most challenging one, since our thoughts sometimes diverged, but through this divergence, our perspective evolved and changed, bringing us to a greater understanding of our challenge and creating solutions to address it.

The last phase of the Design Thinking Process is the prototype, when the ideas generated during the ideation become tangible in a more refined visual representation.

The prototype of the classrooms was made through the software Adobe XD, and changes regarding the space continued even after the ideation phase. Because we could not visually represent everything, each prototype was followed by a brief description of the use of furniture and technology, specifying what was missing in the visuals.

The Design Thinking Process does not end with a visual prototype, but we would need to test our solutions to validate our ideas and design assumptions, get feedback and iterate the process.

II-B. Stakeholdership

1. Instructor

The change from traditional learning to active learning depends on what instructors do and think. We conducted surveys to explore the opinions of professors from VUB and from other universities. The survey conducted for professors from other universities is used as an example of extremes for our design thinking process.

a) The opinions to active learning center

The results of the survey show that 92.3% of the professors in VUB and 100% of the professors outside VUB think it would be useful to have an active learning center in faculty. Professors play an important role in promoting active learning center projects and this result demonstrates that most of the professors have already known the advantages of active learning. That is a very good beginning which means for the professors, they would accept the concept of active learning and use our active learning center if our project meets their other needs and solve their other concerns.

b) The opinions to changing the way of teaching

The results of the survey show that 53.8% of the professors in VUB and 100% of the professors outside VUB would be more motivated if change the way of teaching from traditional to active learning way, and 46.2% of the professors in VUB feel confused about the change but are willing to try it. Although most professors have a growth mindset, changing a way of teaching which has been used for many years is not easy. In the processes of changing, professors might suspect the goals of changing, the effect of changing and the difficulty in changing. And how to implement the change of teaching and how they could support students in the active learning center also confuse professors sometimes.

However, our sample is very small and is not able to represent all the professors in VUB. When we are designing our project, we would take the professors' resistance of innovative learning methods into consideration and also think about how to support the professors during the changing processes.

2. Students

We think of students as the potential beneficiaries of change, and as important participants in the process of change, so that the active learning center can really be useful. We conducted two surveys to explore the opinions of students in the VUB and other universities. The survey conducted for students from other universities is used as an example of extremes for our design thinking process.

a) The opinions to active learning center

The results of the survey show that 100% of the students in VUB and 96.7% of the students outside VUB think it would be useful to have an active learning center in faculty. If students are active participants in their own studying, they will benefit from this innovative learning way, and this result demonstrates that most of the students have already known the advantages of active learning.

b) The opinions to peer tutoring

The results of the survey show that 92.6% of the students in VUB and 100% of the students outside VUB think that peer tutoring is useful in learning. During peer tutoring, students can learn from teaching and become more responsible while doing something worthwhile to help others. Peer tutoring has been proved to be an effective way of learning, and the physical environment and support are needed to help students to adopt this approach.

c) The opinions to the way of learning

The results of the survey show that 59.3% of the students in VUB and 73.3% of the students outside VUB would be more motivated if they change the way of learning from traditional one to active one. 70.4% of the students in VUB and 78.3% of the students outside VUB prefer the combination of studying alone and in groups, less than 20% students prefer studying alone. Although our sample is not big enough, we can see students in higher education would try new ways of learning if it would benefit their academic performance, and more support and guidance are needed when they are using our active learning center.

3. The administration

We did not conduct a survey of the administration, but we considered them into designing. The most important things they would consider is whether the active learning center is useful or not, if students and professors would like to use it and how much money they should allocate on this project.

II-C. Mindsets, Methods, Extremes and Mainstreams

To design this active learning center, we see us as human-centered designers, not just problem solvers. Based on the surveys of professors and students, we design the prototype, and based on the prototype, we will conduct interviews with the stakeholders of this project. Even if this project is being put into the real world, we would continue to test it and then refine it.

1. Mindsets

a) Creative confidence & Optimism

Before designing this active learning center, our group explored the active learning theories in depth, and also reviewed the practical studies. Based on what we learned from previous studies, we have the belief that we can and will come up with the solutions to get better learning and teaching experiences and outcomes. This creative confidence drives us to make things, to test them out and to make it better. We might get wrong, but we would refine it then get it right.

Changing from a traditional way of learning to active learning is challenging to both instructors and students. Even if they understand the meaning of the change and are willing to change, the obstacles get in the way, such as the increasing workload for instructors and the resistance of students. But bearing in mind the optimism mindset, we believe that every problem is solvable.

b) Empathy

Our design is human-centered, and the project is premised on empathy. We explore the opinions of professors and students about what kind of chairs, tables, technology are most needed in our learning center, we put instructions in our active learning center to make sure professors and students know how to use the new classroom, and we would do anything that meet our stakeholders' needs to have better user experiences in our learning center. Empathy means thinking from users' perspective, during any processes of our design, we would put this mindset in front.

c) Learn from failure & Iterate

We think about the failures we might have, such as nobody wants to use this active learning center, or everyone thinks it is the same one with traditional one just with more technologies, or someone sees using this learning center is a burden to their daily life. We might be so inspired at first but depressed when failures come. But with the mindset learning from failure, we see failure as a chance to improve. We can research and explore in depth on the failure and re-design our project, we can conclude from users' feedback and refine our project. By iterating, we can have more ideas, and we can try more approaches and unlock our creativity.

2. Methods

a) Inspiration

As we designed the active learning center, first we researched the active learning pedagogies and the studies on the physical learning environment, then we framed the challenges we might face and the problems we tried to solve. We created a plan including our timeline and budget of this project. Then we brainstormed what information and ideas from our stakeholders that we really need before we design this project, then we conducted surveys.

b) Ideation

From what we researched from studies and the results of surveys, we believe that the active learning center is a good project not only benefits students but also professors. Students can learn in an innovative way and can learn from professors and peers, professors can be more creative in teaching and the interactions between students and professors would be more effective.

To design this active learning center, we consider all the technologies and furniture that could be used in it, and if they are user-friendly or effective, and most importantly, it is within our budget. We also learn from active learning centers in other universities, then do some change based on our research and surveys to make our own prototype.

We believe our project will work not only on the theoretical bases, but also from the success from other similar projects. And we organize plans to refine our project anytime when we see new problems. And we also provide continuous support for users in our active learning center.

c) Implementation

After thoughtful planning, we are going to sell our ideas and project. We would persuade the faculty administration to support our project design financially. During the implementation, we also need to get feedback and suggestions from professors and students and do some refining at the same time. After the active learning center finished, we would continue to assess the academic performance of students and the experiences of professors and students in using our active learning center.

3. Extremes and Mainstreams

Based on the survey results, we should interview those students and professors who prefer active learning and are willing to change as mainstreams of our project. And as for the extremes, we also should interview those who prefer studying alone and those who feel stressful if change happens.

When talking to extremes, we should ask them how they will use our active learning center, and if we want them to use our project, what changes should we make. For the mainstreams, we should consider the details of their needs and try to meet their needs in our project. Unfortunately,

we did not conduct any interview, but we analysed the mainstreams and extremes in designing our project.

II-D. Essential and Crazy, What-if Questions

Essential questions

1. Do stakeholders see things the same as us? Differently?

From the results of the surveys, we are delighted to see that most of the students and professors are willing to change the way of learning and teaching. That means if our active learning center is designed properly, they would like to use it and it can be helpful in their daily learning and teaching. However, although many of them welcome this project, they might have the novelty at the beginning, if they do not know the significance of active learning, collaborative learning and peer-tutoring, or if they do not use it properly, the active learning center might become normal classrooms just with technology. We would design not only the physical environment of the active learning center, but also the guidance and instructions of using it.

2. What are we worried about?

We are worried that after the novelty wore off, students and professors would not use the active learning center anymore. For students, studying in an active learning environment means more participation and more efforts to be made. If they are not motivated, they might feel more relaxed learning in a passive way. For professors, they are more familiar with teaching in a traditional way without much communication with students. They might feel more stressful and time-consuming in designing for active learning classes. Therefore, we are thinking about how to keep them using this active learning center for a long time.

Crazy questions:

1. If both the students and the professors do not like using this center for classes, what will it be ?

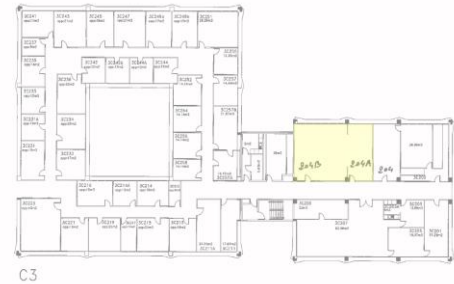
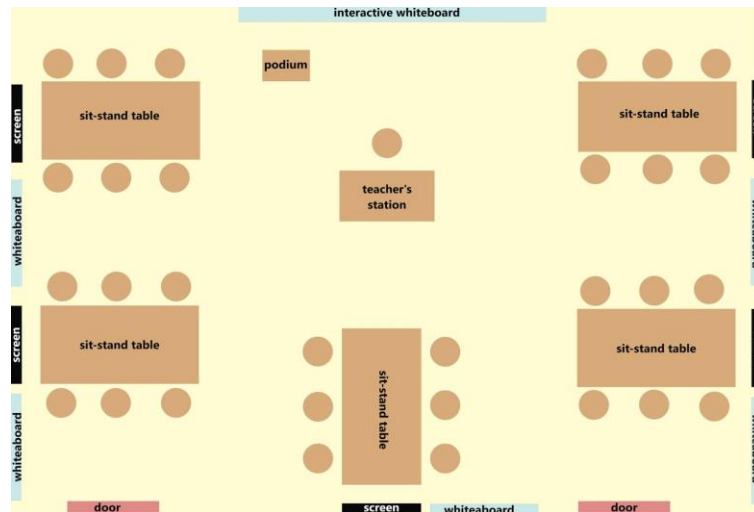
We have devoted energy and time in designing this center, the faculty also will spend money on it, all of us would like to see it work well. And based on the theoretical knowledge and examples of other universities, we believe active learning is really good for our study. So if the students and professors do not like using the center, there must be something wrong with designing or the infrastructure. We will do some improvement on the center.

2. What will we do if the active learning center becomes a playing center?

Since there are so many technology devices in the active learning center, students might use them for playing. And students can stay there chatting, not about studying. We should limit the use of the technologies and make some rules in the active learning center.

II-E. Solution: Prototype (Vision Only)

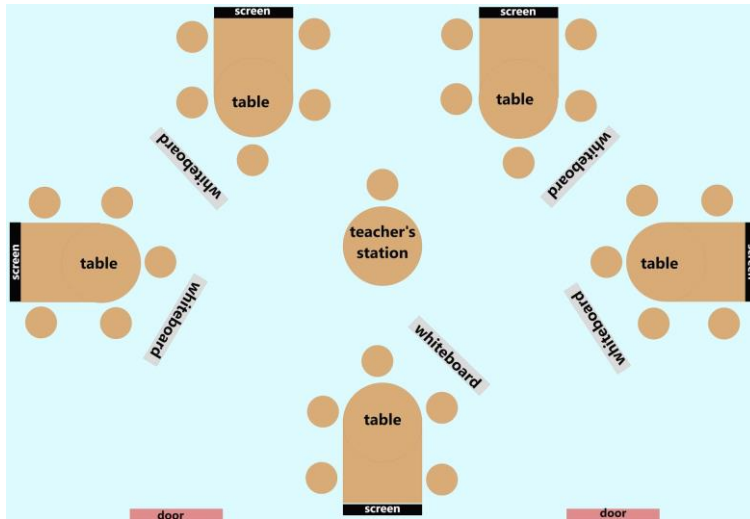
Active Learning Classroom



Room 1 (204 B-204 A)
6,5m x 9,5 m
63 m²

An Active Learning Classroom is a space that stimulates an active, collaborative, student-oriented learning. Therefore, this place is ideal for activities that involve groups working on projects, discussions, brainstorming and presentations. Students work in groups at adjustable sit-stand tables, with a mobile screen and whiteboard on the wall for each table. There are about six chairs on wheels that can be positioned at different heights in each table to increase mobility. Sit-stand tables allow standing and change position, which can positively affect students' energy levels. Face-to-face seating encourages student engagement and team collaboration, but there is also the space for one or two extra chairs if required. It is preferred that students are equipped with their own laptops, even though some computers will be available on request for those who need it. Because students will use computers extensively, each table will provide USB charging ports. The instructor monitors the class from the middle of the room to be close to each of the students when providing classical instruction, while offering one-on-one interaction with students when moving around the tables. Instructor's station, as the other tables allow a sit or stand position and is equipped with a USB portal and a chair with wheels. This space allows for extensive screen management controls. Instructors can show a presentation on the screen of each group or specific groups. Groups can work on a larger screen connecting their laptops and share the results of their work with the rest of the class, or with specific groups. Students can move their screen when presenting their work to enhance the visibility of the screen and facilitate classroom discussion. An interactive whiteboard at the end of the classroom allows for more opportunity of interaction between groups, individual students, with their instructors and with information itself. In front of the interactive whiteboard, a podium with a built-in microphone can support a laptop for presentations or lectures.

Hybrid Active Learning Classroom

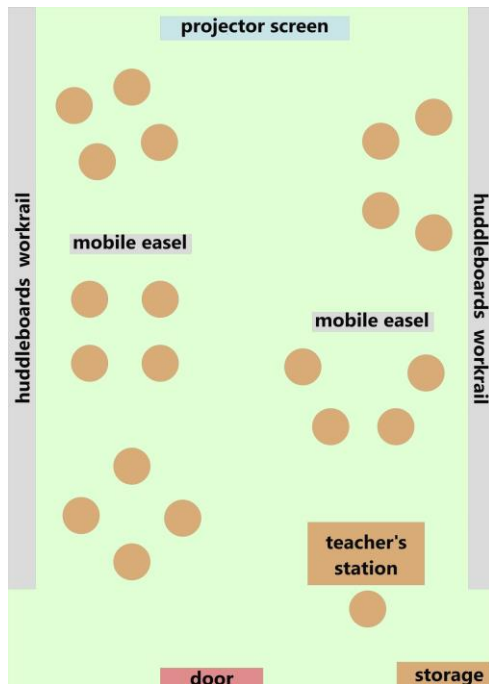


C3

Room 2 (204 - 3C202)
6,5m x 9,5 m
63 m²

A Hybrid Active Learning Classroom is an Active Learning Classroom that allows a simultaneous combination of face-to-face and distance learning. This place facilitates interaction between students present in the classroom and instructor with the remote learners as if they were physically present. A large screen of about 50" showing online students is mounted on a stand attached to the flat side of the table, so that students can feel part of it and closer to the other students. An external camera and microphone under the screen encourage remote students' involvement into the classroom. Many of the Hybrid Active Learning Classroom features are the same as those of the Active Learning Classroom, like the circular dispositions of the tables with the instructor's table in the middle of the room, but some differences occur. In Hybrid Active Learning Classroom, because screens are mostly used to show online students, tables are of a round shape so that each student has better eye contact with the rest of the students. Whiteboards are on wheels to allow a better visibility for those who follow the lesson remotely, having in this way the opportunity to participate in the content creation and display with the rest of the group.

Flexible Active Learning Classroom



Room 3 (3B211)
7m x 5m
35 m²

A Flexible Active Learning Classroom provides an interactive, collaborative, comfortable and versatile learning space. The peculiarity of this classroom is the mobility of all the furniture (screen, chairs and whiteboards) that can be arranged and rearranged to create different configurations as needed.

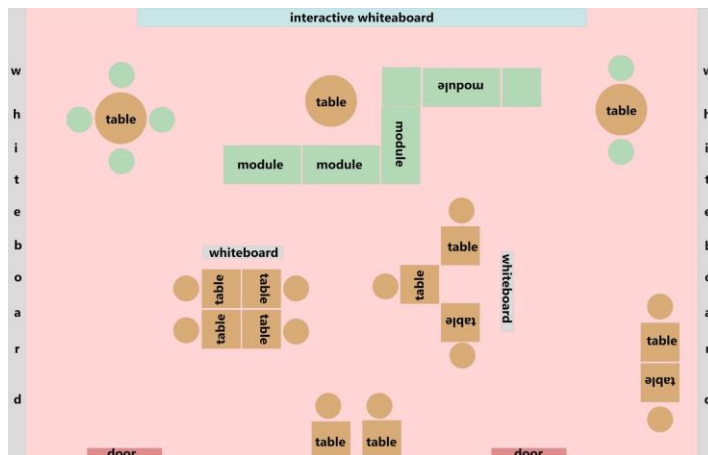
This space is designed for quick, fluid transitions among different kinds of learning strategies and activities, such as lectures, seminars, teamwork, group presentation and discussion. Therefore, it supports both active learning pedagogies and more traditional lecture formats, both individual and group work. Instructor's station has a positional lectern allowing multiple postures during lecture. Instructors can position their table and chair on wheels at any point in the room that best suits their teaching style or activity at hand, and easily move around to advise and assist as needed. In this way, instructors can experiment, and eventually, move gradually to newer teaching styles.

Steelcase node chairs can be positioned in circles during collaboration between small or large groups, in rows during lectures, in a semicircle around the room to allow students looking at each other during class discussion or presentation, and in as many ways as learning modes and activities require. Steelcase node chairs have built-in storage in the base to keep students' personal items with them as they shift among learning modes, and a work surface that supports both individual and collaborative work. Moreover, seatings can be positioned at different heights to allow all students to see and be seen. Instructor's personal items and tools needed for projects are secured in a storage in the classroom.

Active learning center

Lightweight huddle boards can be hung on a work rail or mobile easel for group content creation, sharing and display. Finally, a projector screen can be used for lectures or group presentations.

Informal Active Learning Classroom



Room 4 (3B213)
7m x 11m
77m²

The Informal Active Learning Classroom provides students and the faculty highly flexible, self-customizable furnishings and tools to meet collaborative, privacy and ergonomic needs. It is thought to be a learning environment that promotes a non-curriculum-based, student-directed and non-assessed learning experience.

Informal spaces support students' self-directed learning and their individual learning needs, ranging from focused individual study, to dyadic work or large team collaborative projects. Moreover, this room can be used for peer-tutoring and for informal meetings among faculty.

There are ten mobile tables that can eventually be combined, offering opportunities for coexisting of focused work and social interactions, allowing settings to switch from individual study to group works.

Portable whiteboards, with two-sided markerboard surfaces, can be moved around to define individual or group work areas, while also acting as a tool for sharing ideas and information. On the sides of the room two big whiteboards cover the walls.

Modular lounge seating at the end of the room enhances informal discussions, sharing and collaboration between larger groups. There are six modular sofa pieces, two of which with a backrest that increase at the same time comfort and privacy. To offer different kinds of lounge sittings, there are also six seating stools that can be adjusted at different heights and are easy to carry. They can be easily reconfigured in a variety of ways to accommodate a variety of settings. Round tables offer writing surfaces and support personal items.

Flexible types of furniture not only support different learning needs, but also enable postural changes for short and long-term use, which can positively impact energy levels and well-being.

Active learning center

Therefore, there are different kinds of sittings in this room, ranging from chairs on wheels to seating stools and modular lounge seating.

An interactive whiteboard behind the lounge seatings supports content sharing, brainstorming, and collaboration in a more informal setting.

Environmental factors that apply to all the classrooms

Several studies reveal that the sensory stimulations of the learning environment can facilitate or inhibit the learning process and influence behaviour and social relations (Cantero, 2016). Therefore, lighting, acoustics, temperature and colour variations should be considered when designing a learning environment.

Lighting

Lighting in Active Learning Classrooms should combine natural and artificial light. Luminaires should be mounted in a way that avoids creating reflection to provide a good visibility of screens, and what the cameras capture. At the same time, they should also allow a clear vision when students communicate and cooperate.

A flexible environment such as an Active Learning Classroom, requires a flexible LED lighting system. Lights should be adjusted to support specific teaching/learning mode or particular activity. The color temperature of lighting should be adjusted to match the time of day, which can have a positive effect on our Circadian Rhythm and the environment. Moreover, colour temperature of lighting can have different psychological effects, such as stimulation or relaxation, and can affect mood, perception and performance.

Acoustics

Acoustics in Active Learning Classrooms should follow standard acoustic requirements for reverberation time and background noise level. Effective collaborative teaching and learning environments require controls of sound levels, speech intelligibility, speech privacy between spaces and control of indoor ambient noise. Classrooms should also provide the right acoustic conditions for students who are sensitive listeners, hearing impaired, students with learning difficulties and attention deficits, and non-native speakers (Cheryan et al. 2014).

Acoustic wall panels and acoustic baffles on the ceiling can help to reduce noise and reverberation inside and between the classes, supporting a good speech clarity between groups.

Temperature

Temperature in Active Learning Classrooms should be slightly lower compared to traditional classrooms as students are required to be more dynamic and the presence of technological devices can enhance the room temperature (Graetz & Goliber, 2002).

Classroom temperature and ventilation (outdoor air) should always be monitored by instructors and students, as they were found to be important factors affecting students' health and academic performance (Haverinen-Shaughnessy,2015).

II-F Accounting for Bias

One possible bias for us would be the Google effect, because since information is readily available online, we do not commit to memorize the information (Alleydog.com's online glossary, n.d). However, not all information that we can find online is real, so we searched different articles to know the real meaning of Active Learning Center and all the pedagogical parts to have a good prototype at the end.

Another cognitive bias would be Planning Fallacy. As a group we thought we had enough time to finish our project. For this reason, at the beginning we started doing all parts together and sharing our ideas; however, after some time we decided everyone shall search one part in particular, because time was running against us. Nonetheless, we met every Thursdays with the part that should be discussed and asked for advice in our meeting time.

The third cognitive bias for us is the curse of knowledge. As Educational Sciences students we know what an Active Learning Center is and what type of technology we desired to use. For this reason, doing the surveys for instructors and students was complicated, as we had to formulate them in a language which everyone could understand and explain with details every concept. This took us a long time to have the final surveys to send to students and instructors at the VUB and outside the VUB.

The survey created assumes that the standard teaching unfolds in fairly small groups. However, today the amount of the students, especially in the Educational Sciences faculty has grown. Therefore, it is not certain that for groups of 200-300 students there will be enough furniture.

As mentioned before, since the rooms for this prototype might be small and many groups have to interact at the same time, and this could have a negative impact on the students because it could be too noisy for them. Thus, a solution could be "clickers" defined as an Individual response Technology (IRT), where learners can give responses in real time with wireless devices during the classes (Poirier, C. and Feldman, R. (2007), as a way to introduce active learning even in the large classrooms.

The budget for our project may not be enough, since the hardware cost is very expensive and other activities and rooms have to be taken into account. In this way, priorities will come first and not only the idea of our prototype.

The infrastructure and digital infrastructure should work together. It is important not to leave this part uncovered, such as the digital library, Canvas program. Since without digital connections the prototype cannot work efficient.

Finally, it is necessary to monitor the students who will be using the Active Learning Centres since "continuous monitoring of student performance will assist instructors in adapting their teaching to ensure successful learning" (Chen, E., Heritage, M. and Lee, J., 2009, p. 312) in this new form.

Part III. SMART Metrics | Selling Your Idea

Is it SMART?

1. SMART goal **Specific:**

For the first goal, questions such as the ones below, should be answer:

Who is involved in this goal? Students and instructors from the VUB.

What do you want to accomplish? Students and instructors use the new prototype and provide them positive emotions as they use it.

Where is this goal to be achieved? Another way to use collaborative learning with new technology, where everything will be easier to manipulate and at the same time understand the knowledge.

When do you want to achieve this goal? We would like to have the description in January already

Why do I want to achieve this goal? It will be beneficial not only for us but also for all the faculty and VUB students and instructors.

The first smart goal is to provide a different prototype for four rooms using Active learning theories. The targeted population for this prototype will be students and instructors from the VUB. With the inclusion of the prototype we want to change the traditional way of learning to the use of new devices and technology. Traditional learning methods are not the most adequate methods in promoting collaboration and application of knowledge (Christersson, et al., 2019). To accomplish this goal we need that the university approves our innovation.

These principles allow students to set achievable goals by reflecting on the nature and scope of their focus.

2. SMART goal **Measurable:** measuring process

As read in "Promoting active learning in universities" (Christersson, et al., 2019) an Active learning starts with the layout of a student-centred curriculum which leads students to use their prior knowledge and experiences to comprehend the course content. This Active Learning Center might consist of different spatial, temporal, cultural and curricular varieties for all students. One way to measure progress will be if the connections between relationship and new procedures of working and learning succeed. For this, after implementing the prototypes, we can conduct surveys to know the results.

SMART Metrics should be focused on SMART objectives. Concentrating on SMART metrics avoids common problems like focusing on a vague objective and focusing more on clear objectives, for us: design a prototype at the Vrije Universiteit Brussel and with the help of the stakeholders it can be built by next year.

We developed small goals that can be reachable, such as having meetings to talk about the possible prototype, having a framework and a list of possible resources (physical objects and digital objects) which can be provided for the students and instructors.

Our short-term goal is to show the basic vision of this prototype developed by us, giving to the public the main ideas of how it would look like and to explain the space, the system and the product. For this, we draw some images of how the Active Learning Centres would look like with some images.

Our long-term goal would be implementing the prototype in these different four rooms and also determining the progress students and instructors will have through the experience and usage of them. In addition, if the stakeholders get used to them and if it would be more a support to them, as we expect, or if this prototype would be more difficult and causes more troubles rather than provide an innovative learning.

What is our indicator of progress?

We could use Key Performance Indicators (KPI) to monitor our project. All group members as well as stakeholders and the sponsor, in this case the VUB need to be able to understand the progress of our prototype in the faculties. With the KPIs we could look at the position of the project now and in the future. In this way, we could calculate the success of the prototype at the VUB, which is our main goal.

3. SMART goal **Achievable:**

First of all, for the achievable part, we did four different types of surveys, first two of the team members were selected to create the questions, after this, we met again and made a draft together with the most suitable questions and we all contributed with our opinion and advice for the situation. One important issue is that we decided that for students the option "maybe" will not be allowed, for the reason that we know that many students respond "maybe" to all the answers. According to the four different surveys, the first one was developed to ask about Active Learning Classroom for instructors at the VUB, the second one designed to instructors outside the VUB, then a third survey for students at the VUB and the last one for students outside VUB.

Second of all, we took valuable examples from other universities who already have an Active Learning Center. Such as, Utrecht University and Minnesota University.

Talking about the process of AMC in Utrecht University, it took around two years to convert the Teaching and Learning Lab into an Active Learning Classroom. After this success, the lecturer hall was also converted into an Active Learning Classroom. For this inspiration, we focussed on the success factors for an ALC where it explained that the use of active learning methods can provide better results compared to a class only taught by traditional methods. These new aspects give students an interactive discussion and motivate them. Similar to our prototype, it started with one student who drew the classroom, hired an interior architect and an audio-visual media specialist at Utrecht University. The classroom was fully furnished with six-person tables, where a standing position was also possible. In addition, this position helped students boost energy levels (Teaching & Learning Lab, 2019).

The student, Jasper, who wanted to innovate Utrecht University, took an external example from the University of Minnesota and developed this concept for a course he took that semester. In our case, we also used these two examples for our prototype.

In regard to the University of Minnesota, they have a nine-person table, in a round form but it does not allow to adjust it. However, this encourages collaboration and peer teaching, permits individual and group sharing and has furniture which help groups with few members, and it is available for around between 27 and 126 students per classroom.

4. SMART Goal **Relevant**

A strategy implemented to develop the prototype was the design of the surveys. The surveys, especially the ones sent to instructors from the VUB and outside the VUB, help us define better our objectives, since they provided valuable information related to our final product.

We consider that we should achieve this goal because we know that learning is an active process, where they can use different materials and integrate them in a better way. One of these theories of learning is Cooperative Learning, defined as “the instructional use of small groups so that students work together to maximize their own and each other’s learning” (Johnson et al. 1991, p.5).

Some ways to implement Cooperative Learning can be to assure that the cognitive process be divided in teaching a specific content for a formal learning group and to activate the learning process in informal groups and at the end, professors should give support to the groups. To develop this, to start professors give instructions to the students, then every student goes to a team, where there are materials and finally, the professor checks the learning of the students and if they understand that working as a group is important. As we mentioned before, in cooperating groups, students share their goals and work together to accomplish them. (Johnson, 1991). With collaborative learning, students increase their own learning as well as the learning from the members of the team and with this prototype we assure this knowledge will happen. Our goal is very realistic, since many other universities already have an Active Learning Center and it works well.

We consider that the main reason to create this ALC is the impact it will have on the students from the whole university. Students are willing to use whiteboards, adjustable sit-stand tables and new furniture, which are eco- friendly, meaning no harm for the environment, in an Active Learning Classroom. In addition, from the survey we can prove that all the students from the VUB who answered the survey think an Active Learning Classroom will be useful.

5.SMART Goal – **Timely**

We may consider that the time given was enough, around 3 months to develop the drawing of the prototype or the idea; and we hope that for the next semester we can start making the arrangements to implement the prototype at the VUB if the faculty approves our idea.

Furthermore, with the help of the faculty and the whole university in general to provide the best professionals to construct it and in some months or next year we hope to have it installed. By July we expect that the construction of the prototype in the four rooms will be started.

Is it Sellable?

1. Glimpse of possible prototype

For this prototype we decided to use four rooms at the VUB. The four rooms have different types of Active Learning Classrooms. They are fully described in the section: Vision of prototype in the section II-e Solution: Your Prototype (Vision Only). However, here will be a short description of our possible prototype.

Our first idea is one Active Learning Classroom created for projects, brainstorming and presentations where there are adjustable tables, mobile screens and a whiteboard for every table. Ideal for instructors, as they will be in the center of the classroom during class and an excellent option for students as they will have a USB in each table!

Later, as a group we think a Hybrid ALC is perfect for all students and since the situation of COVID is still here, it allows students who can't be present to be present online. But how is this possible? The room will have screens on every table to show online students. We consider this hybrid one of the most important innovations, since we are an example of online students

The third option is the Flexible ALC which has wonderful environmental-friendly furniture. Another advantage is that traditional lectures can be organized here as well as new active learning strategies. Instructors can move around the classroom using tables on wheels and students can use Steelcase node chairs. Something different from the other rooms is the huddle boards workrails.

Do you want some traditional learning strategies but still an innovative way to learn? then the Informal Active Learning Classroom is for you! From the surveys we consider that some students still prefer traditional classrooms (11,1% against 77,8%) that is why we decided to create this room. In addition, students can study individually or in groups. You can find from comfortable sofas to chairs with wheels in this area.

We consider that all these four options are beneficial for instructors and students and the prototype should be sellable, since we are focusing on learning and not only on infrastructure. Apart from these descriptions, we are helping the sustainability of the staff of the university as well as the planet, avoiding negative products for climate change. It is known that there would be some insecurities if this prototype is ideal for the students at the VUB; however, what we are offering is quality, comfort and easier ways of learning as well as the possibility to create new connections with other students from the class. Moreover, the Active Learning Center is now offered at many other universities and it is proven to become a good investment for the universities which include it. A benefit for the VUB would be that we will be talking about this new creation to other people or family members giving prestige to our university.

As VUB students, we invested much time trying to figure out the best way to create this prototype, we identify good examples as references to do our prototype. Also, we have considered for this creation the budget of €70 000 provided by the sponsor, which we took very carefully into account as well as the meters given for the construction.

Finally, as we learned the Diffusion of Innovation theory, we are convinced that we are part of that 2.5% of innovators who want dreams to come true.

According to Joyner (2010) people decide depending on their emotions and justify them with logic.

2. Diffusion of Innovation Theory

Taking into account the Diffusion of Innovation Theory, describing the meaning "diffusion" it occurs through an innovation of learning. It will depend on whether the innovation is better for the members or not, sometimes innovations are unworthy. Motivation and needs might be distinguished by the degree of innovativeness that people have. According to Rogers, the meaning of innovation is "An innovation is an idea, practice, or project that is perceived as new by an individual or other unit of adoption" (Rogers, 2003, p. 12). He also mentioned that an innovation can be created a long time ago but if the people perceive it as recent or modern, this will continue being an innovation for them (Sahin, 2006).

Rogers also reported a process called The Innovation-Decision Process, where a person is inspired to increase certainty about the advantages of an innovation and reduce the uncertainty. This process contains five steps: knowledge, persuasion, decision, implementation and confirmation (Sahin, 2006).

1. The knowledge stage:

The existence of innovation is learned by someone who asks for information about it. Asking questions such as: what? How? Why? and in the meanwhile the person tries to understand the meaning of innovation and the working process.

2. The persuasion stage:

At the time the person develops a negative or positive perspective against innovation, the persuasion happens. People construct their attitudes after they experienced the innovation. The persuasion could be more feeling centred whereas the knowledge stage is more cognitive centred. Therefore, in the persuasion stage, the person is more sensitive about the innovation. However, the colleges or peers' opinion influences the person's opinion regarding to the innovation.

3. The decision stage:

Here the individual makes a choice about adopting or rejecting the innovation. Using a trial basis could help accepting the innovation, because people can try it in their own situation and later be an adoption decision. If it gets rejected, it could be an active or passive rejection.

4. The implementation stage:

A problem developed here is normally the uncertainty of the newness, so technical assistance to reduce the degree of uncertainty is necessary.

5. The confirmation stage:

Attitudes are important at this stage. Here adoption of the innovation or discontinuance could happen. The latter one happens in two different ways, the person does not accept the innovation; instead he prefers a better innovation or the other possibility is that the person rejects it because he/she is unsatisfied with it.

Rogers also defined "the adopter categories" as individual's classifications in innovativeness (Rogers, 2003). The Diffusion Theory describes five different categories: innovators, early adopters, the early majority, the late majority, and the laggards.

a. Innovators

They intend to experience new ideas. Rogers mentioned that the innovators are protectors from innovation. According to Rogers (2003) innovators are visionaries and enthusiasts, they are not afraid to fail and like to explore repetitions. They have a high tolerance for risk, uncertainty and ambiguity.

b. Early adopters

They have barriers through the social system, rather than the innovators. Early adopters assume leader roles in the social system so they give advice regarding the innovation to other members. If early adopters accept the innovation, the uncertainty decreases.

c. Early Majority

Compared to early adopters, early majority do not have the role of leadership. Nonetheless, the innovation is accepted before the other half of majority (late majority). They usually wait until the innovation has been in practice.

d. Late Majority

Normally they are questioners or sceptics. As mentioned previously, they accept the change later than the early majority. They follow the innovation at the moment they see the other half of their peers are already doing it.

Laggards

Previously to adopt an innovation, they would need to be certain that it works, but they accept the change later than late majority. Laggards decide after knowing the innovation has succeeded and their decision period is usually very long. It is also important for them to value their tradition.

Part IV. Reflections on Educational Change

Leadership Theory

In several fields, including psychology, management, sociology, public administration, political science, and educational administration, leadership plays an undeniably central role (L. S. Harris & Kuhnert, 2008). A number of research approaches are now covered in the area of leadership studies (Gambrell, Matkin, & Burbach, 2011; Horner, 1997). A leading figure in the field, Bernard Bass, once famously wrote in this respect: "There are almost as many different definitions of leadership as there are persons who have attempted to define the concept" (Bass & Stogdill, 1990). Under the microscope, leadership is defined by an expanding collection of concepts such as:

(1) Leadership is the behavior of an individual when he is directing the activities of a group toward a shared goal (Hemphill, 1957).

(2) Leadership is an interaction between two or more members of a group that often involves a structuring or restructuring of the situation and the perceptions and expectations of members...Leadership occurs when one group member modifies the motivation or competencies of others in the group. Any member of the group can exhibit some amount of leadership (Bass & Stogdill, 1990).

(3) Leadership is that process in which one person sets the purpose or direction for one or more other persons and gets them to move along together with him or her and with each other in that direction with competence and full commitment (Jaques & Clement, 1994).

The definition of leadership is a theory of its causal elements (Jaques & Clement, 1994). In organizational behavior schools, leadership theories are also divided into different categories: trait theories, behavioral theories, contingency theories, and contemporary leadership theories (Hay & Hodgkinson, 2006). Also in management, thought leaders have developed different theories and strategies in leadership, such as distributed leadership, moral leadership, transformational leadership, and educational leadership (Celep, 2004; Celik, 2000; A. Harris & Spillane, 2008; Hoy & Miskel, 2004).

Learning and leadership are intertwined as conceptions emerge from our perception of what human beings are about (Lambert, 2002). To be human is to learn, and to learn is to develop sense and understanding of the universe. Therefore, constructivism has emerged as an important educational viewpoint that changes how the world is perceived by educational scholars, authors, professional developers and leaders. This viewpoint on learning has given rise to the awareness that constructivism is critical to learning for adults and organizations. This view has also required a re-examination of the idea of leadership and a new meaning, called "constructivist leadership," has taken shape. The concept of constructivist leadership theory is based on the same ideas that underlie constructivist learning.

Constructivist leadership is referred to as reciprocal processes that enable educational group members to establish meanings that contribute to a common educational goal (Lambert, 1995). Leadership, therefore, takes place within the context of processes or relationships among people within an educational community such as school. Reciprocal relationships are the foundation through which people can create meanings. Old assumptions can be reconstructed within the context of reciprocal relationships, which can in turn lead to the development of new schemes and altered practices. Constructive leadership is not a hierarchical leadership theory, as it extends to leadership and learning at different times for all members of the school community.

Leadership can be discussed in this context as a notion that transcends persons, roles and behaviors. Therefore, instructors, staff, parents, students, everyone in the educational environment should participate in leadership acts. Constructivist leadership continues to separate itself from prevailing conceptions of leadership that affect education, particularly with regard to who leads. The concept of Constructivist leadership does not modify, but rather is reconciled with educational improvements and goals. This style of leadership encourages rather than guides the process of learning. At the heart of the Constructivist approach is that learners, not instructors, monitor their own learning. Recognizing that each learner understands, processes and gives meaning to lessons in his or her own reality, constructivism gives priority to personalized teaching methods that take into account individual learning needs. Leadership that would change our schools and our communities must be cognizant of the essential actions needed to alter the lives of instructors in the schools. The need for sense-making, coherence and seeing educational communities as growth-producing entities is addressed by constructivist leadership (Lambert, 2002). Lambert (1995b, p.83) emphasizes that one of the key roles of the Constructivist leader is to “lead the conversations” since conversations “serve as the medium for reciprocal processes” and allow leaders and followers to make sense of the talk or dialogue. In simple language, conversations provide an opportunity for people to exchange ideas and points of view on particular topics. Constructivist is about immersing instructors in a culture of learning and enabling them to take risks. It’s not about dictating to instructors on how to deliver instructions rather about educating instructors that we are all learners.

Constructivist learning theory behind Active learning

Active learning approaches are now popular and frequently associated with constructivism. Although constructivism was not a pedagogical teaching, in learning practice, many of its followers developed practical applications of the theory. Some scholars even think constructivist learning is a more suitable name for active learning. (Cooperstein & Kocevar-Weidinger, 2004). Constructivism, as its name implies, sees learning as a method of building or creating something. Constructivism argues that people learn about the world by making sense; they make sense of what they experience (Wilson, 2017).

The constructivist theory says that the concepts follow the action rather than precede it and that new experience builds on an already existing knowledge (Brainerd & Piaget 2003). The ideas of constructivists led to four important principles of active learning:

1. Learners construct their own meaning (learners are not passive knowledge absorbers, they make knowledge meaningful and useful in a new situation);
2. New learning builds on prior knowledge (learners combine old and new information and make sense of it);
3. Learning is enhanced by social interaction (learners resolve conflicting ideas in social settings participating in small group activities first and discussions within the entire class later);
4. Learning develops through "authentic" tasks (learners' activities should simulate those that will be encountered in real life). (Cooperstein & Kocevar-Weidinger, 2004).

All the above principles mean that, according to Bloom's taxonomy, learners are more capable of analyzing, evaluating and synthesizing ideas, thus achieving higher order skills. Bloom and his collaborators have developed a framework for the categorization of educational objectives, consisting of six key categories: knowledge, understanding, application, analysis, synthesis and evaluation (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956).

Active teaching and learning classrooms have long provided instructors who aim to increase the effectiveness of in-class teaching and make classroom observations. (Birdwell, Roman, Hammersmith, & Jerolimov, 2016). However, the recent advent of the Active Learning Classroom, designed to facilitate active and collaborative learning practices, has not been directly discussed in classroom observations. In this sense, its implementation in enhancing the teaching-learning process and the impact of constructivism on Active learning classroom practices must be considered in order to understand the potential of creating an Active learning classroom. Since a close relationship exist between Active learning methods and constructivism, the implementation of each one benefit the other.

Constructivism is a social cognitivism-based philosophical and psychological approach that suggests that individuals, actions and environments interact in a reciprocal fashion. (Schunk, 2012). Constructivism notes that learning takes place in contexts and that learners make up a lot of what they learn and understand as a result of their experiences in situations (Gilakjani, Lai-Mei, & Ismail, 2013). Constructivism is basically a theory based on observation and scientific study of how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences (Bereiter, 1994). When we encounter something new, we have to reconcile it with our previous ideas and experience, perhaps change what we believe, or perhaps discard new information as irrelevant. In any event, we are active creators of our own knowledge. To do this, we need to ask questions, explore and evaluate what we know about it. In the classroom, the constructivist approach to learning can point to a number of different teaching practices. In the most general sense, it usually means

encouraging students to use active techniques (experiments, real-world problem solving) to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. The instructor ensures that he or she acknowledges the pre-existing conceptions of the students and directs the activity to address them and then expand on them (Oliver, 2000). Constructivism has its origin in philosophy, psychology, sociology, and education (Bada & Olusegun, 2015).

Teaching requires information transfer, but it's also far more than that (Fernando & Marikar, 2017). Teaching theories must be responsive to the mechanisms by which learners obtain information or, in other words, how learners learn. It is in this aspect that constructivist teaching and learning theory have much to say in relation to the mechanisms by which students gain knowledge. Paulo Freire, educational theorist credited as a founder of constructivism, argued that education should be about learning not teaching; learning as in a place where individuals construct their own knowledge personally and socially (Freire, 1996; Jonassen, 1991; Wertsch, 1988). A participatory approach in which students actively engage in the learning process is advocated by constructivist teaching and learning theory (Jonassen & Rohrer-Murphy, 1999). For Ernest von Glaserfeld constructivism as a theory of knowledge puts forward the following two principles: "knowledge is not passively received but actively built up by the cognizing subject; and the function of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality"(Von Glaserfeld, 1989). As stated by von Glaserfeld, the essence of the constructivist approach to teaching and learning is that the student or learner is an active participant in the learning process and that the instructor needs to take that into account in the instructor's attempt to promote learning. He also makes an effort to relate the philosophy of constructivism to teaching practice. Instructors remain integral; however, their role vacillates between expert, guide, and facilitator (Haberman, 2010), and learning becomes the focal point rather than teaching. Constructivist learning environments require student work that motivates them inherently; learners who achieve a certain level of self-direction; and instructors who provide support (scaffolding), context, relevance and constant feedback. Learners are encouraged in these settings to draw on prior experience, think critically, reflect, and present their individual information and in small groups.

As the skill of students improves, they are responsible for both the material and the learning process, which enables the instructor to play a non-expert, facilitator, or guiding role. Grading becomes replaced by self and peer evaluation, which shifts the educational focus from an intrinsic experience to another intrinsic one and increases student's motivation to be self-directed in the long term (Furtak, Seidel, Iverson, & Briggs, 2012; Michael, 2006; Michael & Modell, 2003; Norman & Schmidt, 1992).

The fundamental principle of constructivism is that "significant learning takes place when the student seeks to make sense of the material presented by selecting appropriate incoming information, organizing it into a coherent structure and integrating it with other organized knowledge." (Mayer, 2004) and that learning is an active process in which learners are active

sense makers who seek to build coherent and organized knowledge. There is considerable evidence of constructivist principles in use today in higher education, and because the broad umbrella term of 'constructivist' or 'student-centered' teaching practices covers a range of different methods (Baeten, Struyven, & Dochy, 2013) it can be argued, as Meyer does, that "Constructivism can no longer be viewed as an exercise in radical thinking primarily aimed at generating innovative teaching. It has become an integral part of the pedagogic mainstream". Constructivist approach is not about teaching but about learning.

Educational Change Reflections

The world outside of the school is slowly undergoing changes (Hinrichs, 2007). We are at a crossroads of a big paradigm shift in education (Prawat, 1992) where vast numbers of individuals are open to drastic changes in education.

Fullan writes:

Real change whether desired or not, whether imposed or voluntarily pursued, represents a serious personal and collective experience characterized by ambivalence and uncertainty and if the change works out, it can result in a sense of mastery, accomplishment and professional growth. The anxieties of uncertainty and the joys of mastery are central to the subjective meaning of educational change and to success or failure-facts which have not been recognized or appreciated in most attempts at reform (Fullan, 2005).

In the international debate on systemic education reform, the notion of the subject matter of leadership has emerged as a core theme in recent decades (Browne-Ferrigno & Björk, 2018). This issue of research in Educational Administration and leadership not only captures a common sense of dedication to education as a way of fostering national social, economic and political well-being but also represents the evolving a nature of leadership across a wide variety of educational organizations and contexts.

The growing complexity of education in the 21st century has therefore ensured that successful leaders appear to rely less on centralized, hierarchical systems and more relational methods at all levels to accomplish tasks (Browne-Ferrigno & Björk, 2018). In this sense, working harmoniously together in the educational field has become an important feature of organizational life and leaders can include a number of stakeholders (instructors, parents, school board of governors, management members, students, opinion leaders and other players in the educational field that matters). The key to creating a healthy and inclusive learning atmosphere for students is to bring invested and trusted stakeholders into the decision table (Hinrichs, 2007). This builds collaboration to help define and address complex issues, organize work, promote cooperation, overcome conflicts and develop engagement to achieve mutual goals (Edmondson, 2012; Handy, 2007; Parker). A good collaborative model is school leadership that includes all of the key stakeholders. This model will help to draw on the best expertise of all stakeholders to better solve the particular challenges faced by educators and families today (Hinrichs, 2007).

Learning institutions recruit leadership to guide all stakeholders to create a positive path for schools to encourage the growth of our schools. Leadership is one of the most dynamic and multifaceted phenomena in human behavior study and the quest for factors associated with

Active learning center

successful leadership (Sant'Anna, Lotfi, Nelson, Campos, & Leonel, 2011) has been on for decades.

Leadership for the future then will need to be as a squad, a group of powerful individuals who each carry their specific strengths decision-making table (Hinrichs, 2007). Therefore, for example, the implementation of different leadership theories that bring about improvements at an individual level will explain the transformative nature of leadership and the critical nature of leadership and the significant impact of the change process on individual actors. Furthermore, the change process modelled in this way has the potential for educational change regardless of institutional setting, as enhanced reflective and adaptive capacity improves the ability to learn from experience (Kolb, 1984).

Part V. Appendices

Appendix V-1: References

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Appendix V-2: Management Design and Structure

Since the start of this project, we have started meeting weekly to stay focused and work continuously. After a few meetings where we discussed pedagogy and active learning spaces, which none of us have ever experienced before, we created a "Slack" workplace to share some interesting findings that in the already existing WhatsApp group could have been mixed and therefore lost among other messages. However, since not everyone knew about "Slack" and because we were using "Google Drive" at the same time to share articles divided into folders, we no longer used "Slack".

We made a Google Drive folder shared with all group members, as it was important for everyone to be involved with all the material we used. All academic articles we read were stored and sorted into categories in the folder. Also, we kept the recording of our meetings, so that every group member can return to the recordings to review them if necessary for developing their ideas. The surveys we conducted, as well as our writings were stored on Google Drive.

Our weekly "Zoom" meetings and communications on our Whatsapp group proved sufficient. We all agreed to meet once a week to discuss all parts of the paper and to contribute to every task. In this way, every group member was encouraged to be familiar with the entire course material and to participate in every part of the project. Using this approach, we developed as many ideas as possible. This was very useful, given that all members of the group had great ideas that helped individual group members to finish their own tasks in the best way. We decided to split the document equally, although we worked together on each part of the project by doing our research and bringing the results to our meetings to support each other and create more thoughtful content.

The division of the paper into five parts was not easy, but we did it without complications. After reading through the whole template carefully, we created an excel file where we decided approximately how many pages there would be for each part and wrote our names next to the parts we would consider making. In the next meeting, we defined our tasks and split the pages equally, although we remained flexible in changing them in case some parts required more or fewer pages. After that, we had another table where we wrote the topic that would be discussed at each meeting so that everyone could come prepared and bring new ideas and perspectives. Being aware of the development of the document also helped us to write the paper as homogenous and fluent as possible. Given that we had our weekly discussions regarding every part of the paper, we all contributed to the entire paper. Although we did divide the paper without difficulties, the most challenging part was that we could not know in the beginning how many pages exactly will be written for each part. Some of the parts needed more writing than expected, and some less.

We conducted four surveys by using 'Google form' on Google Drive, which allowed all group members to be involved by seeing the surveys and later the results. As part of our design thinking process in developing a prototype for the project, we wanted to hear opinions from professors and students. Two surveys were developed for professors: one was only for professors from the

Active learning center

VUB, and the other for professors from other universities, which we intended to use for the 'Extremes' part of the design thinking process. One of the remaining two surveys was developed for the students from our university and the other one for the students from other universities, to use them also for the 'Extremes'.

Working in groups made us realize how important it is to listen to other suggestions. People of different personalities and nationalities have different views on many ideas, which could enrich our knowledge. Also, we learned that it is important to be patient and to not judge other people, but to instead consider and reasonably accept or reject proposed ideas.

Appendix V-3: Budget

Prices for furniture are searched for online on multiple websites, with possibility to ship to Belgium. The most appropriate furniture is chosen and prices in euros are shown in the following tables.

Table 1: Active Learning Classroom: (in total =10,955€)

Furniture	Quantity	Price per item	Price in total
Sit-stand tables(large)	5	339	1695
Sit-stand tables(small)	1	285	285
Chairs on wheel	33	65	2145
Podium	1	150	150
Interactive whiteboard	1	2000	2000
Mobile screens	5	600	3000
Screen stands	5	60	300
Whiteboards on the wall	5	100	500
LED lights	8	110	880

Table 2: Hybrid Active Learning Classroom: (in total = 12,530€)

Furniture	Quantity	Price per item	Price in total
D end round tables	5	642	3210
Instructors' lectern	1	200	200
Mobile whiteboards	5	162	810
TV screens	5	600	3000
Stands for screens	5	60	300
External microphone	5	30	150
External webcam	5	30	150
Chairs on wheels	22	65	1430
Acoustic panels	40	60	2400
LED lights	8	110	880

Active learning center

Flexible Active Learning Classroom: (in total = 12,100€)

Table 3: Furniture	Quantity	Price per item	Price in total
Steelcase node chairs	20	400	8000
Huddle boards	5	420	2100
Conference lectern chair on wheels (teacher)	1	500	500
Storage	1	200	200
Projector screen	1	300	300
Projector	1	60	60
LED lights	1	500	500
	4	110	440

Table 4: Informal Active Learning Classroom (in total = 12,164€)

Furniture	Quantity	Price per item	Price in total
Single tables	10	76	760
Chiars on wheels	10	65	650
Settings stools	6	55	330
Modular sofa	6	50	300
			0
Low tables	3	100	300
Interactive whiteboard	1	2000	2000
Mobile whiteboards	2	162	324
whiteboards on the wall	2	2000	4000
acustic panels	40	60	2400
LED lights	10	110	1100

Estimated price in total: 47,749 € (the price does not include costs for the staff)