

THE COTTBUS EXPERIMENT THREE FIELDS OF COMPETENCE

Richard Knoll, Dipl.-Ing., Assistant Professor
Henri Praeger, Dipl.-Ing., Assistant Professor
Faculty of Architecture, BTU Cottbus, Germany
Konrad-Wachsmann-Allee 6, 03044 Cottbus, Germany

Object of our paper is to restructure the architectural design curriculum in the first cycle of a three-cycle structure of higher education (bachelor/master/PhD according to the Bologna process). This paper is a report of our ongoing experiment on design education at Brandenburg Technical University (BTU) Cottbus. It is rooted in and nourished by the special environment at BTU. Major characteristics of the BTU are the focus on design as the core of the architectural education and studio-based design classes affiliated to one chair of design for three consecutive years.

Educational Goals

The Bologna Process aims to widen the horizon of the educational landscape to a European level. By doing so the necessity emerges to define a set of standards by which study programmes from universities throughout Europe may be compared to one another.

In Germany so far universities roughly described their courses of studies by defining the subject matter and the number of terms needed to take all exams.

Whereas, within the framework of the Bologna Process courses of studies are defined by the competencies a graduate of the course actually obtains. This is a radical change from an input to an output-orientation in higher education.

The consecutive three-cycle structure is the future model of architectural education. The reorganisation of architectural studies resulting in bachelor and master degrees offer the one-time opportunity to review and reorientate the subject matter and structures of the courses of studies that have hardened over the past decades.

While the Master degree is greatly comparable to the former diplom-ingenieur, the bachelor degree is radically new in the German educational landscape. Especially the layout of the bachelor-courses needs careful consideration.

So can we describe the competencies a bachelor of architecture should have gained? What can a future employer or university expect him or her to know?

In our function as assistant professors at one the Brandenburg University of Technology in Cottbus our aim was to describe the educational goals of the design courses in the bachelor program of architecture. As we will point out we thereby attempted to systematically restructure the three-year courses of architectural design.

Three fields of competence

National Qualifications Frameworks

In 2005 the association of universities and other higher education institutions in Germany (HRK) and the German Ministries concerned with education resolved the national qualifications frameworks (NQF). These NQF outline the profile of qualification of bachelor and master degrees at German universities according to the specifications of the European qualifications frameworks. Further specifications of these rather general outlines are explicitly left to departments of the universities organizing bachelor programs.

The qualifications of a graduate with a bachelor degree are subdivided into three fields of competencies:

Instrumental, systemic and communicational competencies.

The instrumental competencies enable the graduate to apply his skills and knowledge to his future profession. He can develop and evolve arguments and solutions in his field. These competencies can be described as technical and vocational skills.

The systemic skills point at something else: they describe the capacity to autonomously collect and evaluate relevant information and come to scientific conclusions. Relevant information can be derived from social, scientific or ethical fields and need not to be directly professional. The systemic skills provide the intellectual basis the instrumental competencies.

The expectations seem to be rather clear in the field of the communicational skills. Students should learn to express and argue their conclusions and to explain their ideas, problems and solutions likewise to experts and a wider audience.

The Fields of competence in architectural design

How can the NQF help us to restructure design education in the bachelor programm?

The basic strategy to define the goals of education and subdivide the skills to three categories seems to be reasonable. To avoid any misunderstanding one must underline that any subject matter contains elements of all three fields – possibly with different focus points – so that within the education of architects the design education needs to foster skills in all three fields.

Two questions will need to be answered: How can we adequately describe the fields of competence for the education of architects? And what exactly are the design competencies a bachelor of architecture would be expected to have acquired?

Of course to match the Requirements of architectural education we need to redscribe the three fields of competencies:

Skills and Knowledge

We would like to summarize the instrumental competencies and label them as “Skills and Knowledge”.

This field of competence covers the entire tool-kit of a practicing architect. It contains all practical skills needed when handling architectural problems. These may be skills in the use of design-tools as well as factual knowledge in all fields effecting architectural design.

This field claims the major part of traditional architectural education. Because listing all competencies in this field would be endless and of no help, we suggest subdividing this broad field into the following five categories.



Space

Space is the primary matter of architecture. Architecture creates, defines and structures space. The perception of space and the ability to think in three dimensions are basic to any spatial design.

To feel confident when dealing with spatial problems many skills are required: spatial operations such as addition and subtraction or superimposition may be needed as well as sequences, stacking or any arrangement of spaces.

The designing architect also needs to have control over the psychological impact different spaces can have upon us: how do

narrow or vast, open or enclosed spaces affect us? How can the space-defining surfaces be configured purposefully?



Geometry

The generic term geometry summarizes all technical and graphical means that enable the description and development of space. It encompasses descriptive geometry and computer-aided design as well as rules of proportion and the correct use of scale.

This group of competencies describes all tools that can help to describe space or develop and control three-dimensional space.



Material

architecture is materialised space.

Before the actual construction of a building the knowledge of the properties of building materials is essential in the design process. On one hand the physical properties of material define the structural system which determines possible spatial developments. On the other hand the sensual properties of material like the texture, colour and its appearance under light determine the space-defining surfaces.



Context

Architecture never is autonomous.

Any Building is connected to its environment in multiple ways. It can blend into its surrounding or stand in contrast to it, it may be connected to its environment in a formal or ideal manner but never can it be understood without context. Therefore Architecture should not be designed without consciously respecting the context. The term context summarizes the external forces informing a piece of architecture such as landscape, urban surrounding, genius loci or cultural references.



Programm

Because architecture is an applied art it needs to bridge the contrast between practical and esthetical value, between function and art.

One of the essential competencies of an architect is the ability to organize complex and multiple needs and to transform them into a spatial order. A broad knowledge of the principals of spatial organisation is necessary to achieve this task.

Conclusion

Of course it is hardly possible to differentiate these five groups of instrumental competencies in detail. In this context we can only briefly outline them. Any architectural problem requires skills and knowledge from several, if not all of these. But our aim is to create an instrument supporting us in the task to establish a new structure for the design curriculum. As we will illustrate later this subdivision enables us to define the educational focus of each semester course. We will show that over the six semesters the educational focus shifts from one to another, each containing competencies that provide the basis necessary to fully comprehend the next.

Naturally, the described skills and knowledge alone are not sufficient to become a good architect. Two thousand years ago, Markus Vitruvius Pollo was concerned with the question what the competencies of an architect should be. In the first of the ten books on architecture – dealing with the fundamental terms of architecture and the education of architects – he wrote:

“The architect should be equipped with knowledge of many branches of study and varied kinds of learning, for it is by his judgement that all work done by the other arts is put to test. This knowledge is the child of practice and theory. Practice is the continuous and regular exercise of employment where manual work is done with any necessary material according to the design of a drawing. Theory, on the other hand, is the ability to demonstrate and explain the productions of dexterity on the principles of proportion.

It follows, therefore, that architects who have aimed at acquiring manual skill without scholarship have never been able to reach a position of authority to correspond to their pains, while those who relied only upon theories and scholarship were obviously hunting the shadow, not the substance. But those who have a thorough knowledge of both, like men armed at all points, have the sooner attained their object and carried authority with them.”

(Vitruvius, The Ten Books On Architecture, translated by m. h. morgan, 1914, harvard university press)

After dealing with the skills and knowledge architects need to design – the *practice* – we will continue with the competencies Vitruvius describes as *theory*.

As Vitruvius defines we believe that theory contains *many branches of study and varied kind of learning* beyond the practical skills and knowledge and also *the ability to demonstrate and explain the productions of dexterity* which describes the communicative competencies of an architect. In fact the definitions in the NQF show great analogies by defining the systemic and communicative competencies. Relating to the subject of architectural design we choose to label them as intellectual stimulus and communicative competence.

Intellectual stimulus

„We cannot expect to go on extracting ideas and schemes from the student without first ... continuously feeding his mind and imagination”

(Comments in Hoeslis Diaries, 1953-1957, in the Hoesli Archives, ETH, Zürich.)

More drastically one could say: a pig fattens by feed, not by weighing.

We would like to describe two major forms of intellectual stimulus. The first is the feed of the students mind and imagination that can occur in fields outside of architecture. Therefore one major task of design education must be to broaden the students horizon and open their minds to the inspiring fields beyond architecture.

The second subject we want to describe deals with the design process itself. How does design emerge? Is the creative process controllable? What could design strategies be and how can they help? We need to supply the student with a sufficient knowledge of design strategies to sustain his ability to act.

So the field of intellectual stimulus will contain two categories: expanding the horizon and strategies of action



Expanding the horizon

“Someone who knows only music understands nothing about it”
(*hanns eisler*)

It is hard to imagine designing architecture without the guidance of good examples may they be buildings or persons. Architects need to

have an overview of the variety of approaches and styles existing in their profession. In architectural design education this takes place in lectures, books, exkursions et cetera. And yet architectonic examples alone are not enough. To avoid architecture from becoming self-referential it needs a broader scope of information and inspiration. The architect can find such inspiration in the fine arts – as Vitruvius pointed out “it is by his judgement that all work done by the other arts is put to test”.

In design education it is essential to uncover the strong connections between architecture and the fine arts but also open other fields as possible sources of inspiration:

literature, philosophy, natural and social sciences or even politics may inspire or inform the design process. Of course studying architecture can not be a *studium generalis*. But we are convinced, that students need to constantly be encouraged to explore the inspiring potentials behind the horizon.



Strategies of action

Design is more than trial and error.

Designing means making decisions. Unlike in simple mathematics most design problems are impossible to solve clearly without ambiguity. The designer is either confronted with too little information or an overwhelming amount of information, demands and wishes. To sustain his ability to act the architect needs strategic competence.

Instead of hoping for the brilliant masterstroke solving all problems instantly students should be introduced to different strategic approaches of design problems. They need to learn to develop criteria that enable them to evaluate their sketches and designs and need to acquire a variety of decision-making strategies.

Once armed with a sufficient tool-kit of skills and knowledge and with the necessary intellectual background the designing architect still lacks the ability to share his competencies with others. This third field of indispensable skills is the communicative competence.

Communicative Competence

Architecture is communication!

Architecture is an integrative discipline because it is necessary to communicate one's ideas and concepts and understand and evaluate the wishes and knowledge of all parties involved in the design process and come to an integrated solution.

Within architectural studies this integrative task must be faced to a special degree by the design courses. Therefore it is no surprise that we try to encourage the development of the communicative competence.

To communicate however an architect needs to know what he is doing. And this actually is a crucial point of any didactics: a conscious reflection of one's action often just begins when asked to explain it. So the reflection of one's action is the precondition for communication.

Both the willingness to reflect on one's designs and the actual communicative skills are trained in design education. All designs are presented to a larger group in the studio, which fosters the visual and graphical as well as the rhetorical skills. Working in a studio with fellow students facilitates the development of a debate culture and the ability to accept and convert criticism.

And yet we believe that more can be done. On one hand we must assert, that the classical means of communication of an architect – draft and model – have been complemented by a large number of new media whose targeted employment should be learned. On the other hand we think an even stronger reflection of one's work can produce knowledge that leads beyond the narrow confines of the current projects.

We will therefore subdivide the communicative competence in these two topics: communication and reflection.



Communication

As we mentioned the number of communicative media an architect should be able to use is large and growing: speech, discussion, writing, draft, model, photography, diagram, layout, powerpoint, webdesign, flash-animation, rendering et cetera. Their number has escalated due to the digital revolution taking place and many of these make design issues much more accessible to a broader public.

Within a three year bachelor program it is impossible to expect students to gain mastery in all media but we think it is necessary to convey at least basic knowledge of those beyond the classical drafting techniques to enable a multimedia-based communication. Another aspect seems to be of importance as well: while normally presentations show the results of the design process some of the other media are more adapted to concentrate on the creative process itself. This leads us to the second integral component of communicative competence:



Reflection

Looking into the mirror we can catch our reflection. Even more: we can see what lies behind us and – at second sight – we can see our surrounding and the position we are taking within it.

This is exactly what a designer should learn: to take a good look at himself and the path that lies behind him. The retrospective view enables him to assess his current situation as well as the context and the decisive moments that have led to the resulting design.

The awareness of the process that led to the resulting design – and often this awareness will not appear until in retrospect – can help knowledge to emerge that is transferable to new assignments.

Essentially reflecting upon one's designs can uncover two important aspects: the evolving character of design and how any design is influenced by the designer's personality. At best careful reflection can lead to more awareness of one's working methods and self-confidence as a designer.

Summary

Our aim was to describe the educational goals of the design courses in the bachelor program of architecture. To do so we defined three fields of competence, each of them subdivided into distinguishable groups:

The first field – *skills and knowledge* – contains all practical skills needed when handling architectural design problems. Its elements are space, geometry, material, context and program.

The second field – *intellectual stimulus* – attempts to broaden the student's horizon and gives him strategic competence to sustain his ability to act.

Finally the third field – *communicative competence* – aims at the development of a well-reflected attitude towards architectural design and the process of designing, and at acquiring the competence to communicate in multiple ways.

Once again: we do not claim to completely define the competencies architectural design calls for. Instead we hope to establish an instrument helping us to restructure the design curriculum. In the next chapter we will explain the strategies we applied to convey these competencies in the three-year bachelor curriculum of architectural design.

Curriculum

Having separated our aims in design education into three fields of competence it is now necessary to think about ways to convey those competencies to the students.

By analysing the subjects taught we have developed the outline of three year curriculum. But let's first have a look at the true meaning of the word curriculum.

Many teachers at universities nowadays complain that with introduction of the new bachelor and master degree programmes the necessary content can not be conveyed in a three year undergraduate course. Furthermore it is criticised that the strict structure of such courses is pretty much school-like and does not reflect freedom in education- a major characteristic of university teaching. Students are supposedly forced to rush through their studies and only respond to the immediate tasks at hand without time for reflection. They have to merely focus on delivering the demanded results and be sufficiently efficient.

Without trying to find the ultimate solution to this debate we want to comment on some of the aspects in the following.

Three years is a long time.

We do object to the opinion that a certain amount of content can only be conveyed by means of a larger amount of time spent for the undergraduate degree. Design competence is not acquired passively by means of a gradual maturing process but by active learning in an appropriate and stimulating ambience. Factors like enthusiasm and passion play a decisive role in the success of the individual student.

Architects like many other professionals are subject to a lifelong learning process. We do therefore believe that a discussion about the amount of time needed to be a sufficiently well trained designer does lead into the wrong direction.

It is vital to create a stimulating ambience for students to be able to make the most of their time at university.

A major element of creating this ambience is the introduction of a well structured curriculum that does enable and support the student's personal and individual growth. In the following we will explain why this approach does not necessarily lead to a more school-like education but it has to be noted that a certain "crispness" in the arrangement of content is nevertheless necessary.

A curriculum is no walk in the park. The term itself is the noun to the latin verb *currere* meaning to rush, to run. The latin curriculum even means racetrack, racing cart or just race.

There is no time to be wasted in a three year curriculum and as we have mentioned above the content to be taught is extensive. Nevertheless it is possible to convey it in a manner that the students don't feel simply rushed through their course. It is necessary to edit the subjects taught in a way that for the students short term aims are always within visible distance to guide the students acting and help separating the whole "race" into manageable legs.

But how to structure the curriculum?

Method

The teachers in architectural design at university are generally architects and most likely novices in the field of didactics. They have acquired their competence in architectural design in their profession. When teaching they are forced to develop a method of transferring their experiences to the students.

A well accepted strategy believes in learning by doing as an autodidactic process. If that was true, the form of design tasks and their sequence would not matter in architectural education. At the same time this implies that one has to rely on the students to draw the right conclusions from their actions. They would have to reinvent principles and design strategies on their own without being led to the right conclusions.

This is bound to fail for the majority of students.

Another possible strategy in teaching is remembering your own education and ("it did not harm me") provide the same education to the younger generation of architectural students. This is no doubt the most common strategy and many valuable approaches were handed over from one generation to the next.

With the substantial changes in European education connected to the reduced three year undergraduate course, this approach can only partially work in future.

To master this challenge we follow a separate strategy:

The structure of the curriculum should be developed from the content itself and hence harmoniously integrate into the new educational framework.

Having developed a clear vision elements of the passed down educational models can then again be integrated at the right place in the curriculum.

This is the reason why we have not tried to simply find the right didactic model among the existing ones but have firstly focused on the structures and potentials embedded in the subject itself.

Everyone who has once tried to convey a subject of substantial complexity to somebody else knows that this process as well leads to an own fresh and clearer sight on the matter. This phenomenon is the nucleus of a didactic method arising from the content to be taught itself. In order to develop a methodical teaching model it is vital to intensively analyse the subject.

John Dewey wrote in his key work "Democracy and education":

"Method means that arrangement of subject matter which makes it most effective in use. Never is method something outside of the material."¹

[...]

"Method is not antithetical to subject matter; it is the effective direction of subject matter to desired results. It is antithetical to random and ill-considered action, -- ill-considered signifying ill-adapted."²

A simple example from the field of zoology can explain this phenomenon. Zoology as a science is not represented by a mere collection of facts on animals but by the fact that this information is embedded into a well thought out classification system. Only this classification system allows the science to become a background for further research as new knowledge can be ordered in relation to the existing information. If one applies this principle to a didactic method one arrives at the following conclusions:

¹ John Dewey, „Democracy and Education“, 2007, NuVision Publications, LLC, chapter 13, p.138

² John Dewey , chapter 13, p.138

Firstly:

A strong structure necessary for an effective application of the subject matter can be found in the subject itself. One therefore has to find the inner structure of the subjects in the field of design to develop a structure for the curriculum.

And secondly:

The application of the subject matter follows a certain aim - that is a successful teaching – and should be well thought out and adapted to the students situation.

The second conclusion will be addressed later after we have described the semester structure. But beforehand we will try to extract the structure of the curriculum out of the established classification system of the three fields of competence as mentioned above.

The intrinsic structure of the Fields of Competence

The teaching targets connected to the three fields of competence describe the competencies to be acquired by the students in their undergraduate course. This reflects the desired shift to an output oriented teaching model intended by the Bologna process.

To evaluate the fields possible influence on the development of a curriculum, one has to examine each field separately.

Skills and Knowledge

The first field of competencies – Skills and Knowledge – covers the classic tools of architectural design, that is space, geometry, material, context and program. Looking at those one realises that the order in which they are put here already contains a chronological aspect that can be used to structure the curriculum.

As space is the primary medium of architecture it is just logic to concentrate on the appearance and perception of space at the beginning of the course. Simultaneously the geometric operations and tools to illustrate and develop spatial arrangements need to be trained. Once these abstract basics are established one can address the factors that determine the spaces tangible characteristics.

Material determines the space's appearance due to its inherent engineering attributes and its outer surface.

It is vital to understand space's basic principles of formal idea, construction and joining methods before considering external

factors. Factors like context from which architecture evolves and the consideration of complex program finally crown the development from an abstract space to a specific and unique architecture.

This sketched sequence of creating architectural space is very much simplified because the mentioned steps are never taken one at a time but overlap and take place simultaneously. But still it does help us to define focal points within the curriculum which change gradually over the course of six semesters. [see Figure 1]

This timely structure is furthermore supported by the permanent increase in complexity of the objects to be designed. Whilst the basic phenomena of space can best be studied using laboratory like conditions and abstract spaces, the design tasks grow in complexity in line with the introduction of urban context or the necessity to fulfill a complex brief.

Experiences made in a smaller scale are built upon in the following semesters therefore the content taught in one semester has a preparative function for the next. The abstract spatial studies and their results of the first semester for example will be referenced when designing a more complex building in the third semester and this is an important guideline for handling complex spatial structures in the final design project in 6th semester.

We do regard it as a fortunate coincidence that we have the opportunity to develop a curriculum in architectural design for the whole undergraduate course rather than focussing on one specific year only. This allows us to define a structure where the content of the terms is very much interwoven and built one upon the other and students can always revert to experiences made before. That way we can develop a much more effective curriculum than could be done in schools with independent courses per year.

The same principles are valid for the field of competence:

Intellectual stimulus

Expanding the students horizon is encouraged with the semesters main focus in mind. This can be achieved with the help of lectures, field trips or readers. All of them help to provide references reaching beyond the concrete architectonic task of the semester. Nevertheless those references are always chosen in close connection

with those tasks and provide points of contact for retroaction during the course.

The students are guided to important background information from the field of architecture theory, parallels in fine arts or other disciplines.

This information supports the teaching and underpins the focal point of the semester.

The character of content with respect to the *strategy of action* is similar. Students have to learn to be able to develop one adequate design strategy with respect to a certain task. With this strategy they will also stay in control of the design process and have the capacity to act. It is not intended to develop a kind of patent remedy but to develop a broad repertoire of strategies leaving the student with the choice for the most appropriate one.

In the first semesters the focus is on teaching the advantages of a strategic approach to design. Simple operations defined by the students themselves help to develop a first spatial idea and support the basis of argumentation in the presentations.

They are encouraged to work with an open mind not copying concepts well known but exploring new ideas. Once this foundation is laid the students are able to define own tasks, transfer operations used in other fields to their current work and train designing in alternatives. The different design strategies are not meant to be a good-design-toolbox for all times. They are always tightly connected to the design tasks, architectural theory and last but not least the teachers personal evaluation.

To structure the curriculum it is only important to equip the students with a wide repertoire of strategies and leave them in a position where they can create conceptual designs independently

Communicative Competence.

Some aspects that can help structure the curriculum can also be found in the third and last field of competence, the Communicative Competence.

We have already talked about the importance of the students' conscious reflection of their own designs. The retrospective on (apparently) finished design projects allows the student to conduct an evaluation of each semester. The continuous repetition of reflection within the curriculum helps the student to realise his

personal development over the course of his studies and encourages a dispute about the content taught. Apart from this didactic effect the curriculum is structured into design sequences and regular fermatas.

It is quite obvious that the reflection of the students work provides the ideal occasion to practice different forms of communication. The media changes from semester to semester starting from simple leporellos over exhibition design, portfolios, animated clips, web presentations to more voluminous works as yearbooks. There does not need to be an exact definition of the form of presentation but the obvious choice is to increase complexity over the duration of the course. Basic layout skills trained in first semester lay the foundation for the portfolio in third semester. That way a consecutive structure of the curriculum and its content is created.

It has become obvious, in those examples mentioned above that there are a number of clues for the structure of the architectural design curriculum hidden in the subject matter itself.

Still, by extracting those clues no complete curriculum can be created. They can only help creating the backbone of it.

The individual teacher has to put flesh to this backbone to make it work as a didactic model. Therefore the curriculum needs to be flexible as staff at university changes over time. The liberty for a personal definition of the curriculum by the teacher provides the opportunity to transport personality and beliefs into the process. This is a key factor for a successful curriculum as the teachers personality and charisma are important factors in the successful mediation of content.

We want to close with another John Dewey quote:

“The educator's part in the enterprise of education is to furnish the environment which stimulates responses and directs the learner's course. In last analysis, all that the educator can do is modify stimuli so that response will as surely as is possible result in the formation of desirable intellectual and emotional dispositions.”³

³ John Dewey, chapter 14, p.149

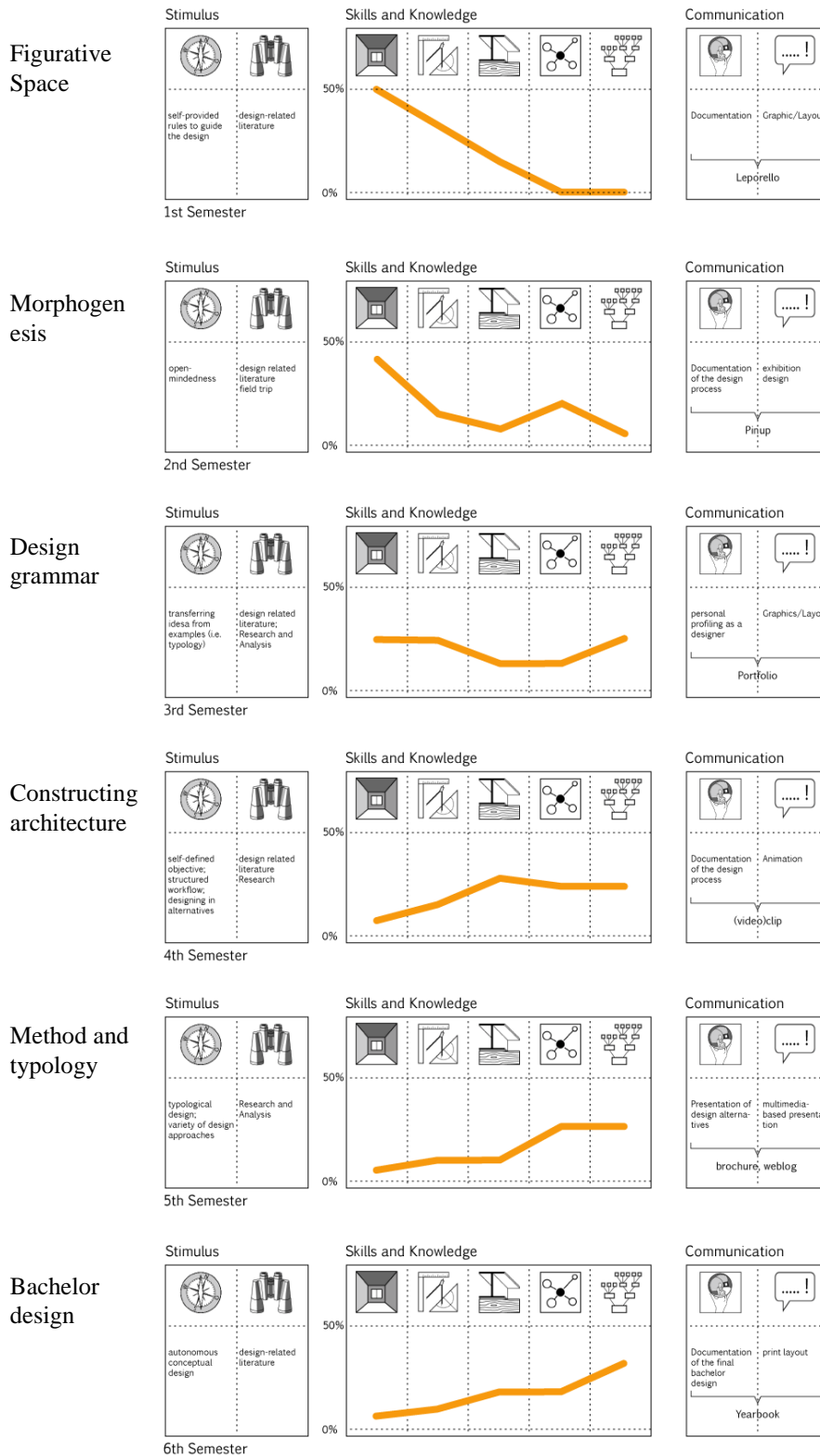


Figure 1: Shift of educational focus throughout the curriculum