







# Design thinking as a methodology in the elaboration of a curricular structure proposal

*Design thinking como metodologia na elaboração de uma proposta de matriz curricular*

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## ABSTRACT

**Introduction:** The medical school curricular structure may vary according to the educational planning of each higher education institution (HEI). The viewpoint of the coordination and the medical school faculty is not always aligned with the students' opinions. Thus, using a methodology to identify the students' point of view would be essential. Design thinking (DT) is a process that proposes a search, in an empathetic, collaborative, and creative way, for solutions to complex problems.

**Objectives:** To present DT as a methodology to identify how clinical internship students believe the curricular structure from the 1<sup>st</sup> to the 4<sup>th</sup> year of a São Paulo state medical school should be, by collecting suggestions and points that require a re-evaluation process of the current curricular structure.

**Methods:** This is a qualitative assessment, which will use the DT model. Students were divided into three groups of five, and each group was committed to having a free discussion on its ideas concerning the curricular structure. Then, a panel was presented to each group, dividing the semesters from the 1<sup>st</sup> to the 4<sup>th</sup> year with post-it notes representing the current curricular structure of the medical school, and each group had one hour to reassemble the curricular structure as they deemed appropriate.

**Results:** After the discussion stage, each group assembled its curricular structure. Some changes concerning the year in which the discipline was provided were proposed, and the inclusion of others. Most of the suggestions were considered valid and were incorporated into the curriculum.

**Conclusions:** The DT methodology contributed to the identification of several demands regarding the curricular structure in an orderly, empathetic, and collaborative way, taking into account the students' opinions. It is, therefore, a planning strategy able to evidence weaknesses and strengths of the curriculum that might not have been noticed by the use of other strategies.

**Keywords:** Curricular Structure, Medical Education, Design Thinking.

## RESUMO

**Introdução:** A matriz curricular do curso de Medicina pode variar de acordo com o projeto pedagógico de curso (PPC) de cada instituição de ensino superior (IES). Nem sempre a visão da coordenação e do corpo docente do curso de Medicina está alinhada às opiniões dos alunos. Assim, a utilização de uma metodologia para identificar a visão do corpo discente seria fundamental. O design thinking (DT) é um processo que propõe a busca, de forma empática, colaborativa e criativa, de soluções para problemas complexos.

**Objetivo:** Este estudo apresenta o DT como uma metodologia para identificar como os alunos do internato acreditam que deva ser a matriz curricular do primeiro ao quarto ano de um curso de Medicina no estado de São Paulo, e, para tanto, coletaram-se sugestões e pontos que exigiram a reavaliação na matriz original.

**Método:** Realizou-se uma avaliação qualitativa com base no modelo do DT. Os alunos foram divididos em três grupos de cinco alunos, e cada grupo dedicou-se a discutir livremente sobre suas ideias acerca da matriz curricular. Posteriormente, apresentou-se um painel para cada grupo com a separação dos semestres correspondentes – do primeiro ao quarto ano – com post-it representando a matriz curricular vigente do curso de Medicina, e cada grupo teve uma hora para remontar a matriz curricular da maneira que julgasse mais adequado.

**Resultado:** Após a fase de discussão, cada grupo montou sua matriz curricular, e propuseram-se algumas mudanças do ano em que a disciplina era ministrada e a inclusão de algumas matérias. A maioria das sugestões foi julgada procedente e incorporada na matriz curricular.

**Conclusão:** A metodologia do DT contribuiu para a identificação de várias demandas acerca da matriz curricular de uma forma ordenada, empática e colaborativa, levando em consideração a opinião do estudante, sendo, portanto, uma estratégia de planejamento capaz de evidenciar fragilidades e fortalezas do currículo que talvez não fossem percebidas por outras estratégias.

**Palavras-chave:** Matriz Curricular; Ensino Médico; Design Thinking.

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## INTRODUCTION

The Undergraduate Medical Course is a bachelor's degree, has a minimum workload of 7,200 hours and a minimum period of six years for its completion. CNE/CES Resolution N. 3, of June 20, 2014, established the National Curriculum Guidelines (DCNs, *Diretrizes Curriculares Nacionais*) for the Undergraduate Medical Course in Brazil<sup>1</sup>.

The curricular structure of the Medicine course may vary according to the Pedagogical Course Project (PCP) of each Higher Education Institution (HEI), with differences ranging from the names of the subjects, contents, educational strategies to the order in which they appear in the curriculum. It may also vary from region to region, favoring the approach of topics according to local epidemiology. However, any curriculum must meet the guidelines defined by the Brazilian Ministry of Education (MEC).

As for the pedagogical project, the curriculum guidelines determine that it should be built collectively, centered on the student as a subject of learning and supported by the teacher as a facilitator and mediator of the teaching-learning process<sup>1</sup>.

The viewpoint of the coordination and the medical course faculty is not always aligned with the students' opinions. Therefore, it would be interesting to develop a methodology using the Design Thinking (DT) model through which it would be possible to identify students' suggestions on the current curriculum structure composition, checking improvement points and contributions to a future structure and understanding which points need reassessment in the current structure according to the experience of these students.

Considering the pedagogical changes that are taking place in medical courses curricula across the country, favoring active methodologies, DT presents itself as an opportunity for students and faculty to collaborate with student-centered medical education.

DT is a cognitive and analytical process that proposes the search for solutions to complex problems in an empathetic, collaborative and creative way<sup>2-4</sup>. As a methodology, its origin is often credited to Herbert A. Simon, in 1969<sup>5</sup>. As a term, DT is attributed to Bruce Archer in 1979<sup>6</sup>. Popularized by Tim Brown and David Kelley, the method begins with designers empathizing with the difficulties of people within the problem environment. Based on observations and analysis of the problem, the designer creates an innovative solution, working directly with people that are most affected by the problem. This new design is then quickly tested and evaluated using end users' feedback to assess improvement.

Some publications have already used Design Thinking as a methodology for curriculum reform<sup>2-4</sup>.

Due to some students' demands of changes in the curriculum, a group of teachers, with the support of the coordination of the medical course, decided to use the innovative DT methodology to evaluate the students' suggestions regarding the curriculum structure.

## OBJECTIVES

To present DT as a methodology to identify how medical internship students believe it should be the curriculum structure of the 1<sup>st</sup> to 4<sup>th</sup> years of a medical course in the state of São Paulo, collecting suggestions and points that require reevaluation in the original structure.

## METHODS

This is a qualitative research that was carried out with the DT model. The project was approved by the Research Ethics Committee under number 4,982,058. All students attending the medical course internship were invited to participate in this research. Among those who were interested, fifteen students were chosen by drawing lots. These students were asked to talk previously with the other students so that the demands would represent the group's collective wishes and not just the participants'.

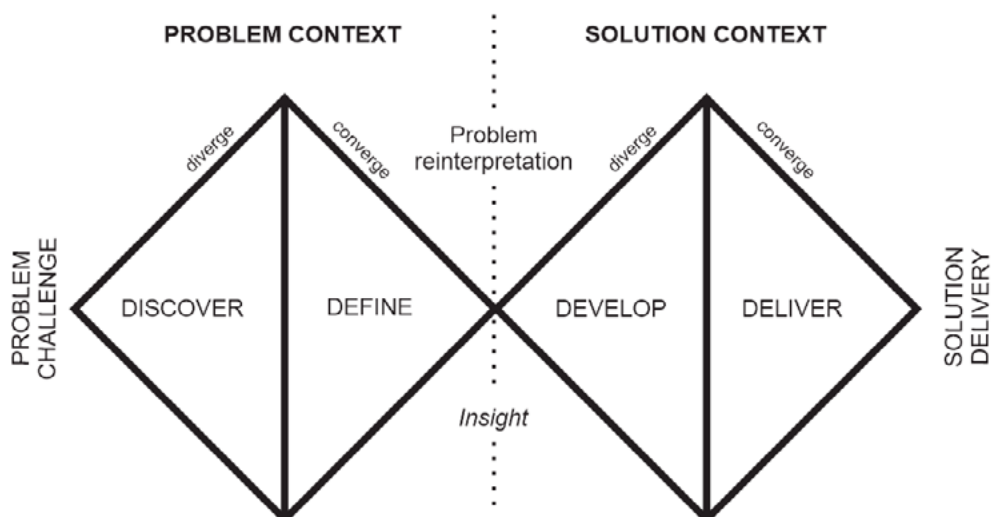
The participants met to carry out the research, and two teachers with experience in the methodology collaborated in the process of conducting the DT stages as advisers of each phase, without, however, interfering with the students' opinion.

After clarification on the objective of the meeting, the methodology to be employed and the filling out of the informed consent form, a fifteen-minute presentation was performed on the main aspects of DCNs by the teachers.

It was decided to use these titles to describe the five phases of the DT process: discovery, interpretation, ideation, experimentation and evolution<sup>7</sup>.

In addition to the 5 mentioned phases, the double diamond model was demonstrated during the presentation. The Double Diamond Method (Figure 1), also known as Double Diamond, is a process approach developed by the Design Council, a design agency, in 2005<sup>8</sup>. This methodology organizes the principles of design systematically in a simple and intuitive structure. The two fundamental elements of this structure symbolize the approach of divergent thinking, which involves the exploration of a problem with an open mind. Then comes convergent thinking, in which the problem is solved through actions. These principles are fundamental in the phases of Design Thinking. "

The first phase is the phase of discovery or empathy; It is a divergent phase, in which the problem is exposed, that is, when the researcher investigates the complaint and interviews

**Figure 1.** Double diamond model.

Source: Adapted from the Design Council, UK – 2005.

the user. It is a phase of collection of information about the users' needs and points of view. At this stage, the end users of the process are interviewed so that the specific demands can be determined, or sometimes the process that makes up the complaint is observed to gather data. Since students had already expressed the desire for changes in the curriculum and they were users and the executors of the process at the same time, the first phase had already been completed.

In the second phase, the interpretation or definition, the participants report their perception of the problem. Interpretation is the phase of definition of the demand to be addressed. In this phase, the limits of the problem are defined by taking the information gathered in the discovery phase. At this point, a discussion was initiated with students about their impressions and considerations about the curriculum structure, without any judgments, as this is one of the requirements of the DT. The considerations were questioned, creating the "How could we..." The "how" implies that there is a solution to the problem itself; the "we" emphasizes the collaborative process and the "could" determines that it is acceptable that an idea may or may not work. In this phase, the methodology that would be employed throughout the process was then debated. This is a converging phase, in which the problem is defined.

The idealization phase, the third one, again a divergent phase, is the moment when all ideas and proposals are gathered to solve the problem. All kinds of observations are valid as they can lead to new insights. At this point, the participants were divided into three groups of five students, and each group dedicated to freely discussing their ideas about the curriculum, expressing their needs and expectations. Group brainstorming is a crucial component of

this divergent step that aims to identify possible solutions to the problem. Each member of the group should be actively encouraged to contribute ideas that can go from the obvious to the absurd, so as not to inhibit the emergence of new suggestions. Sometimes the most radical opinions will be the most valuable ones, as they can lead to the generation of new and great ideas.

The fourth phase of experimentation or prototyping is when a model that can comply with the resolution of the complaint is achieved in a converging way, after the definition of a line of action to be followed in the third phase. For this purpose, a cardboard was previously assembled for each group with the separation of the corresponding semesters from 1<sup>st</sup> to 4<sup>th</sup> years with post-its representing the original curriculum of the medical course (Table 1) (Figure 2).

Each year was assigned with a particular post-it color so that, later, it could identify of what year that discipline was originally part. The first year was assigned the color blue, the second year the color green, the third year the color purple and the fourth year the color orange (Figure 1). Subsequently, the students received pens and pink post-its.

Each group had one hour to reassemble the curriculum structure in the way the group thought it was best for their needs. The structure indicated the semester (s) in which each discipline or module should be taught, as well as new disciplines or modules that are not in the current structure (in pink) and disciplines that should be removed in the students' opinion. The post-its of the removed disciplines were kept so that the disciplines discarded by the students could be identified.

The two teachers worked only as observers at this stage, checking the dynamics of each group so that there was no monopolization or imposition of opinions.

**Table 1.** Original curriculum structure.

1 <sup>st</sup> year	Cell and tissue study I	Human metabolism I	Structure and function Anatomy I	Structure and function Physiology I	Embryology and genetics I	Basic procedures I	Bioethics I
	Cell and tissue study II	Human metabolism II	Structure and function Anatomy II	Structure and function Physiology II	Embryology and genetics II	Basic procedures II	Bioethics II
2 <sup>nd</sup> year	Cell and tissue study III Pathology	Clinical history and physical examination I	Structure and function III	Agression and defense I Parasitology Immunology	Community health		
	Cell and tissue study IV Pathology	Clinical history and physical examination II	Structure and function IV	Agression and defense II Microbiology	Pharmacology		
3 <sup>rd</sup> year	Glandular system	Woman's health I	Otorhinolaryngology Head and Neck	Ophthalmology	Surgery I	Hematopoietic system	Pharmacology and therapeutics I
	Nephrology	Urology	Undergraduate research	Child health I	Digestive system I	Mental health I	Worker's health
4 <sup>th</sup> year	Agression and defense III Infectology	Woman's health II	Musculoskeletal system I Rheumatology	Respiratory system I	Musculoskeletal system II Orthopedics	Urgency and emergencies	Pharmacology and therapeutics II
	Cardiovascular system	Oncology	Integumentary system	Mental health II Neurology	Mental health III Psychiatry	Child health II	Family health

Finally, in the testing or evolution phase, it is the moment when the prototypes created in the 4<sup>th</sup> phase are used to evaluate whether they adequately meet the needs. At this stage, the three suggestions for the curriculum restructuring were placed to the test. Each group presented to the others their suggestion of curriculum structure, justifying each step of the assembly (the reason for the discipline or module, why it was included or justification for its removal). After each presentation, the other students analyzed the structure idealized by the group regarding the coherence and fulfilled wishes, assessing whether the structure proposed by the group met their needs. In the end, a structure was created by consensus.

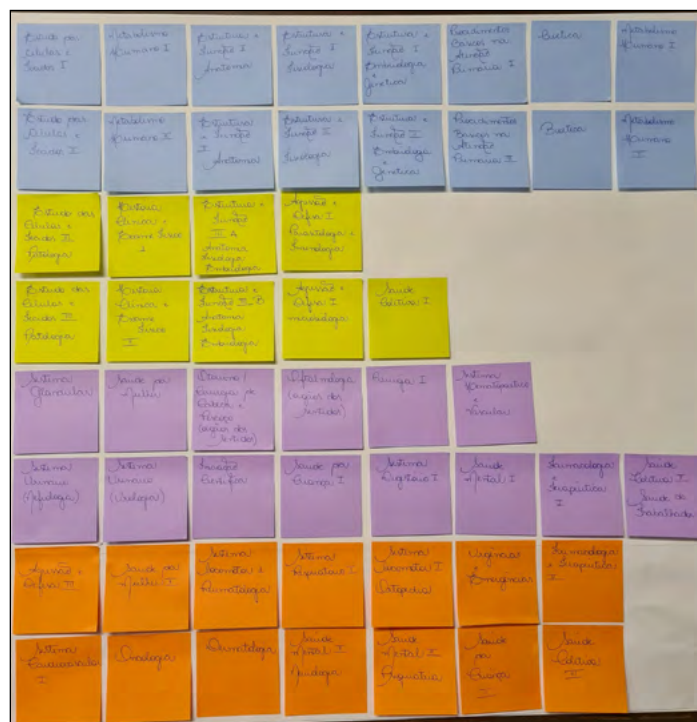
During the presentations, the participants made suggestions of change both in the form of the curriculum structure and in the specific contents of each discipline.

All presentations were recorded, with authorization, and subsequently analyzed by the researchers, including the comments of the other groups about each presented structure and the final discussion to reach the consensus. From these recordings, information was gathered not only about the composition of the new grid, but also of its complaints and needs related to the content of the disciplines.

## RESULTS

In the discovery phase, the students presented their personal views about the current curriculum, raising strengths and weaknesses both in form and content. In the interpretation

**Figure 2.** Original curriculum structure.



Source: Picture taken by the author.

phase, the participants listed the main demands that required attention and, after the discussion phase (third phase), the possible suggestions for the new curriculum (Table 2) were listed. The groups made very similar suggestions. In the prototyping phase, each group set up its own curriculum matrix.



A review published in 2019 indicates that health educators are using design thinking as a tool in the education and training of professionals, patients and students, and that this methodology can be used to shape organizational processes and redesign pedagogical curricula. Consider education as a user-centered product/service and address curriculum development as a design challenge could bring innovative solutions to the many challenges that health education faces<sup>12</sup>.

Another publication postulates the use of DT for the development and implementation of teaching and learning technologies in medical education<sup>18</sup>. The current students were born during the period of digital transformation process and are eager to participate in the teaching-learning process<sup>19</sup>. Certainly, the medical student of the future will learn these skills through collaborative workshops and will have some time “dedicated to innovation” In doing so, they will gain empathy, problem-solving and communication skills that will extend to clinical practice<sup>20</sup>.

In 2015, the Harvard School of Medicine began the preparation and subsequent launching of a new curriculum focused on collaboration and interactive learning. In this project, student leaders worked with teachers to develop a communication advisory model about the student’s perspective on pedagogical changes. The participating teachers modified courses based on student feedback, who were stimulated because they were involved in the process<sup>4</sup>.

Whether the restructuring of the curriculum or any other practical improvement in the medical course, the solution of complex educational problems requires creative thinking to generate innovative solutions<sup>2</sup>. Since it allows the prototyping of ideas, the design approach method can contribute to the resolution of problems in the health area by the students<sup>3-20</sup>.

These apparent benefits, along with the emphasis on science and design, can explain the growing number of medical education programs that incorporate the field of DT into their instructions<sup>16,17</sup>.

The use of DT encourages students’ creativity by allowing them to develop the different stages of this technique, adding empathy to collaboration and action to stimulate innovation. Moreover, given the highly interactive nature of this approach, it is essential that the team consist of open, active and engaged members to ensure the success of this approach.

As reported in the results, the suggestions were presented to the coordination and most of the demands were considered adequate and joined the new curriculum structure of the medical course.

The students participating in the study received feedback from the participating teachers about each of the items.

As educators, we are constantly learning and innovating. The DT provides a powerful process and a growth mindset to help develop creative solutions as we move forward<sup>21</sup>. The fact of observing and recording the work of students allows us to understand the reasons why students propose the curriculum modifications. Taking into account the opinion of students is essential for the success of a curriculum reform, and this attitude is in accordance with the DT, which is centered on the user’s view.

## CONCLUSIONS

The DT methodology contributed to the identification of several demands about the curriculum matrix in an orderly, empathetic and collaborative way, taking into account the student’s opinion.

Thus, we can conclude that DT is a planning strategy capable of highlighting curriculum weaknesses and strengths, which may not be perceived by other strategies. The growing relationship between medical education and DT structure offers an opportunity for new and promising research in this area.

## AUTHORS’ CONTRIBUTION

Mario Augusto Ferrari de Castro contributed with the study concept, data collection, methodology, project administration, supervision, and writing of the manuscript. Andrea Anacleto Ferrari de Castro and Rogério Aparecido Dedivitis contributed to the project design, data collection, investigation, methodology and review of the manuscript. Elaine Marcilio Santos contributed with the study concept, methodology, supervision, project administration and review of the manuscript. Ricardo Edésio Amorim Santos Diniz contributed with the enrollment of participants, development of the methodology and review of the manuscript. Ipojuca Calixto Fraiz contributed to the study concept, methodology, compilation of results and review of the manuscript.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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