

GILBERTO DE PAIVA DIAS

**THE PRE-SERVICE SCIENCE AND MATHEMATICS TEACHERS'
KNOWLEDGE CONTENT ABOUT THE HUMAN BODY AND THEIR
PREPAREDNESS TO FOLLOW THE BRAZILIAN COMMON CORE
NATIONAL STANDARDS (BNCC)**

Dissertation presented as a partial requirement to obtain the title of Master in Science and Mathematics Education at the Stricto Sensu Graduate Program from the Institute of Environmental, Chemical and Pharmaceutical Sciences, Federal University of São Paulo – Diadema Campus, São Paulo.

DIADEMA

2022

Dados Internacionais da Catalogação na Publicação (CIP)

Dias, Gilberto de Paiva

The pre-service science and mathematics teacher's knowledge content about the human body and their preparedness to follow the Brazilian common core national standards (BNCC). / Gilberto de Paiva Dias. -- Diadema, 2022.

112 f.

Dissertação (Mestrado em Ensino de Ciências e Matemática) - Universidade Federal de São Paulo - Campus Diadema, 2022.

Orientador: Camilo de Lellis Santos

1. BNCC. 2. Human Body. 3. Curriculum. 4. Teacher Training. 5. Science Teaching. I. Título.



UNIVERSIDADE FEDERAL DE SÃO PAULO
CAMPUS DIADEMA



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Advisor: Prof. Camilo de Lellis Santos

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To my family of blood and heart, for the unconditional support in the most difficult hours, to my colleagues and master students from PECMA, specially Viviane Aparecida de Sá, to Stephano Gonçalves, Armando Luiz de Paiva Dias, Werleson Medeiros Carvalho and Hayla Raissa Medeiro de Souza for the encouragement and technical support, to my dear professors Leonardo Testoni and Marilena Rosalen, for the wise and necessary academic encouragement, to my advisor, professor Camilo de Lellis Santos, for the excellent guidance and patience, to my dear professors Amélia dos Santos, Maria Aparecida Visconte, Christine Zanczur, Erika Reyes Molina and Selma Isabel Rodrigues and to all men and women of science, who came to this planet to stand out from the most common of the most, making a difference for the humankind. In memoriam, to my dear friend Thamara Cristina da Silveira Monteiro, one of the sweetest people I have ever met.

ACKNOWLEDGEMENTS

To all those involved in this professional, intellectual, and academic challenge process, previously mentioned in the dedication.

"I know that I am intelligent, because I know that I know nothing."

Socrates

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LIST OF ACRONYMS

BNCC	Common Core National Standards
CHEF	Human Body: Structure and Function
EF	Elementary School (Ensino Fundamental)
EM	High School (Ensino Medio)
MEC	Ministry of Education and Culture
PCK	Pedagogical Content Knowledge
PCN	National Curriculum Parameters
PISA	International Student Assessment Program
SP	São Paulo
UC	Curriculum Course Unit
UNESP	State University of São Paulo (Univ. Estadual de São Paulo)
UNIFESP	Federal University of São Paulo (Univ. Federal de São Paulo)
USP	University of São Paulo

RESUMO

A Base Nacional Comum Curricular (BNCC) para o ensino fundamental (EF) foi implementada nos currículos das escolas brasileiras a partir de 2019. Estudos científicos analisando o impacto da BNCC no processo de ensino e aprendizagem das habilidades e competências do componente curricular ciências, sobretudo aqueles referentes ao corpo humano ainda são escassos. A implementação da BNCC ocorreu sem a devida formação inicial ou continuada dos professores de ciências, o que pode gerar inconsistências na docência devido ao desalinhamento entre o conhecimento pedagógico do conteúdo e o currículo obrigatório. Este estudo avaliou o conhecimento prévio de ingressantes de um curso de licenciatura em Ciências sobre os conteúdos de corpo humano previsto na BNCC, e a eficácia de uma unidade curricular (UC) de anatomia e fisiologia humana na promoção de domínio, aprendizagem e segurança para ensinar tais conteúdos. A análise foi realizada com base nos dados coletados por meio da aplicação de questionários estruturados no início e fim da unidade curricular. O estudo comparou os efeitos do ensino remoto no desenvolvimento dessas habilidades possivelmente adquiridas no ensino presencial. Os estudantes possuem maior domínio de habilidades ensinadas no primeiro ano do EF que são relacionadas à higiene e saúde do corpo humano. O menor domínio envolve habilidades relacionadas ao sistema nervoso. As habilidades mais aprendidas na educação básica foram as relacionadas à puberdade, métodos contraceptivos e prevenção de infecções sexualmente transmissíveis. As habilidades indicadas como maior segurança para ensinar após terem cursado a UC foram as relacionadas ao sistema nervoso e locomotor. A UC aumentou significativamente a percepção dos alunos quanto ao domínio geral das habilidades, bem como a segurança para ensiná-las. O desenvolvimento obtido ao longo da UC foi similar em ambos, ensino presencial e remoto. Assim, as habilidades previstas na BNCC e que devem ser ensinadas aos alunos do EF não são completamente dominadas pelos futuros professores de ciências, entretanto, um curso de formação inicial bem estruturado é capaz de prepará-los para a docência.

Palavras-chave: BNCC, corpo humano, currículo, formação de professores, ensino de ciências.

ABSTRACT

The Common Core National Standards (BNCC) for elementary education (EF) has been implemented in Brazilian schools' curricula since 2019 and scientific studies analyzing the impact of BNCC on abilities and competences in teaching and learning process of the science curriculum components, especially those referring to the human body, are still rare. The implementation of BNCC occurred without the proper initial or continuing training of science teachers, which can lead to inconsistencies in teaching due to the misalignment between the pedagogical knowledge of the content and the mandatory curriculum. This study evaluated the previous students' knowledge entering in a Science-Licentiate course on the human body contents provided in BNCC, and the effectiveness of a course curricular unit (UC) of human anatomy and physiology in promoting *mastering*, *learning* and *confidence* to teach such contents. The analysis was performed based on the data collected through the application of structured questionnaires at the beginning and at the end of the UC. This study compared the effects of the remote development of the possible abilities acquired during face-to-face learning. Students have a high *mastering* of the abilities taught in the first year of elementary school (EF) which are related to hygiene and health of the human body. The lower mastering involves the abilities related to the nervous system. The abilities with high learning during basic education were those related to puberty, contraceptive methods, and prevention of sexually transmitted infections. The competences indicated as with high confidence to teach after having attended the UC were those related to the nervous and locomotor systems. The UC has significantly increased students' perception of the general mastering of the abilities, as well as the confidence in teaching them. The development acquired through the UC was similar in both cases, face-to-face and remote groups. Therefore, the analysis showed either that the competences provided in BNCC and those which should be taught to elementary students are not completely mastered by future science teachers, and a well-structured initial training course would improve their competence for future teaching.

Keywords: BNCC, human body, curriculum, teacher training, science teaching.

1 INTRODUCTION

After several years of debates and adjustments between government, schools, teachers, and educators, since the presentation for public consultation in 2015 and its subsequent approval in 2017, the new Common Core National Standards (BNCC) became mandatory in 2020 for all early childhood education. It is fundamental, both in the private and public-school networks in the Brazilian territory, mainly defending the principles of working with abilities and competences, aligning students with the demands of the contemporary world.

Of particular concern, according to Silva⁽¹⁾, the “common” of the Common Core National Standards tends to become “an instrument of centralization and an attempt to homogenize the pedagogical practices developed in our country”, and the biggest challenge in implementing it in all its instances would be, first, a major paradigm shift in education. The curriculum must be revised and the itineraries constructed, and for that, teachers must be minimally willing to study and be prepared for how to work and evaluate competences and abilities, that means, bringing to the fore in their pedagogical practices a concept highly valued in education of the present and the future, which is the “Life Project”⁽²⁾, although the proposal for the new base does not deny or oppose to the concern with employability and the labor market.

The BNCC (2017) draws attention to new ways of learning, teaching, and managing proposals at the base, especially in the basic education, suggesting a significant change in the pedagogical work since it is organized by areas of knowledge and not by disciplines, which will decrease the fragmentation of knowledge and will value meaningful learning, in addition to integrated projects. Therefore, it is also predicted that the forms of assessment will change radically, considering that the planning of the work to be organized according to the development of competences and abilities, which will require new ways to assess students in the procedural and formative manners.⁽²⁾

However, there is another very important expectation that lies on the heart of the BNCC implementation, which is the mandatory presence of active teaching methodologies, especially in high school, which is expected to grow, since the

general abilities proposed by the new BNCC presuppose a protagonist and an active student in the construction of the knowledge.⁽²⁾

Thinking about the training courses for science and biology teachers, the study of the human body, its constituents and its functioning must be included as part of the programmatic content in their formation, since, according to the Common Core National standards (BNCC), a science teacher must be able to teach these contents already in the initial and final years of Elementary School II, more precisely in the 5th, 6th, 7th and 8th years, being these contents taken briefly back later, in High School (EM). Regarding, specifically, to Elementary Education (EF), BNCC (2017) declares that:

“In the early years, it is intended that (...) children expand their knowledge and appreciation for their body, identify the necessary care to maintain the health and integrity of the organism and develop attitudes of respect and acceptance for individual differences, both with respect to ethnic-cultural diversity and in relation to the inclusion of special education students. In the final years, topics related to human reproduction and sexuality are also addressed, subjects of great interest and social relevance in this age group, as well as knowledge of health conditions, basic sanitation, air quality and nutritional conditions of the Brazilian population.”⁽²⁾ (p. 327, our translation)

In addition to content issues, it is relevant to emphasize that the same document proposes that not only the contents related to science and, consequently, to the human body, must be taught to students, but that there is a responsibility, on part of the teachers, to address research and experimentation practices in the teaching and learning process, also according to the BNCC (2017):

“In this sense, it is not enough for scientific knowledge to be presented to students. It is necessary to offer opportunities for them, in fact, to be involved in learning processes in which they can experience moments of investigation that enable them to exercise and broaden their curiosity, improve their capacity for observation, logical reasoning and creation, develop more attitudes collaborative and systematize their first explanations about the natural and technological world, and about their body, their health and their well-being, having as reference the knowledge, languages and procedures of the Natural Sciences.”⁽²⁾ (p. 331, our translation)

Complementarily, in the official document is still specified, this time for High School (EM) the need for the practical components aiming retaking the contents during the EF, together with the scientific resources necessary for the experimentation. The BNCC (2017) emphasizes, for the EM that:

“Therefore, the investigative dimension of Natural Sciences must be emphasized in High School, bringing students closer to the procedures and instruments of investigation, such as identifying problems, formulating questions, identifying information or relevant variables, proposing and testing hypotheses, elaborating arguments and explanations, choosing and using measurement instruments, planning and carrying out experimental activities and field research, reporting, evaluating and communicating conclusions and developing intervention actions, based on the analysis of data and information on the themes in the area.”⁽²⁾ (p. 550, our translation)

In this sense it is expected that the pedagogical projects of undergraduate courses in science and biology corroborate the promotion of experimentation methodologies during the formation of future teachers. Considering the updated pedagogical project of the science course from UNIFESP, where this study was developed, it is stated in it that one of the competences to be worked with undergraduates' students is the domain of general principles and foundations of the Sciences (Biology, Physics and Chemistry), Mathematics and Education, either. Therefore, in the Pedagogical Project of the Science Course (2019) it is determined some specific abilities concerned to investigative teaching practices, such as:

“(...) solving experimental problems, from their recognition and measurement to the analysis of results; proposing, developing and using scientific and mathematical models, recognizing their domains of validity; concentrate efforts and persist in the search for solutions to problems of an elaborated solution; (...) know and absorb new techniques, methods or use of instruments, whether in measurements or in data analysis (theoretical or experimental).”⁽³⁾ (p. 28, our translation)

When we turn to initial and continuing teacher training, their knowledge and preparation throughout their career, in a systematic review presented at the 12th National research meeting in Education and Science – 12th ENPEC – at the Federal University of Rio Grande do Norte, in 2019, researchers Alves et al.⁽⁴⁾, from UNESP, presented as a result that one of the central issues of the teaching are activity concerns the knowledge, that differentiates the teacher as a teaching professional

from other professionals, and that one of the main challenges is to understand and assume that a teacher, as well as other professionals from different areas of performance, must have either their own knowledge, that would characterize and identify their work and would allow their professional practice.

In the same article, the authors concluded that, in this context, that there are several proposals about teachers' knowledge, among which the pedagogical knowledge of the content stands out, or, in English, PCK (Pedagogical Content Knowledge), as proposed by Shulman⁽⁵⁾ (1986), who considers it as the specific professional teacher's knowledge. For this author, such knowledge occurs in the context of the intersection between content and pedagogy, therefore, it is the teacher's ability to transform his content knowledge into pedagogical forms that take into account the students' experiences and background. Such ability distinguishes the teacher from another specialist in the field.

Shulman⁽⁵⁾ defines the PCK as that knowledge:

“[...] which goes beyond the knowledge of the subject itself, to the dimension of knowledge of the subject for teaching. I still talk about content knowledge here, but in a particular form of content knowledge that incorporates the content aspects most relevant to your teaching. Within the category of pedagogical content knowledge, I include the topics most regularly taught in the questioning area, the most useful ways of questioning these ideas, the most powerful analogies, illustrations, examples, explanations, demonstrations, in a word, the ways of representing and formulate content that makes it understandable to others. As there are no single more powerful forms of representation, the teacher must have a real arsenal of alternative forms of representation at hand, some derived from research, while others stem from the wisdom of practice.”⁽⁵⁾

The PCK has been discussed mainly with regards to science teaching.⁽⁶⁾ Goes and Fernandez (2018) also pointed that the PCK is a fruitful model and that it has helped the understanding of the professional science teacher's knowledge, in general.⁽⁶⁾

Talking about the scientific literacy of our teachers, Lucia Helena Sasseron and Anna Maria Pessoa de Carvalho, from USP, in an article published in the book *Science Teaching Investigation – V16(1)*, pp 59-77, 2011⁽⁷⁾, entitled “Scientific Literacy: a bibliographic review”, discussed the concept of scientific literacy, aiming

to understand how this idea has been used over the years, and then trying to identify what abilities the authors point out as necessary to be developed to classify an individual as scientifically literate. In the same article, the authors pointed that, when studying foreign literature related to science teaching, there is a variation in the use of the term that defines science teaching, concerned with the citizens' education of students for action and performance in society.

The same authors previously cited illustrate that Spanish-Speaking researchers, for example, often use the expression "*Alfabetización Científica*" to designate teaching whose objective would be to promote abilities and competences among students capable of allowing them to participate in the decision-making processes of the day-to-day⁽⁸⁻¹¹⁾; in English-language publications, the same objective appears under the term "*Scientific Literacy*"⁽¹²⁻¹⁷⁾; and in French publications, we could find the use of the expression "*Alphabétisation Scientifique*".⁽¹⁸⁻²⁰⁾ Brazilian authors who use the expression "*Scientific Enculturation*" started from the assumption that science teaching can and should promote conditions so that students, in addition to the religious, social, and historical cultures they carry with them, can also be part of a culture in that scientific notions, ideas and concepts that are part of its corpus. Among the national researchers, indeed, there is a preference for the expression "*Scientific Literacy*", justifying this choice based on the meaning of the term defended by two great linguistics researchers: *Angela Kleiman* and *Magda Soares*. Kleiman and Soares (1998) defines literacy as "the result of the action of teaching or learning to read and write: a state or condition in which a social group or an individual acquires, as a consequence of having appropriated writing"⁽²¹⁾ (p. 18)

On scientific literacy in science curriculum, Hurd⁽¹⁴⁾ (1998) comments on the changes suffered by science curricula in the USA during the 20th century. The author recalls that in the 1930s, some manifestations arose in favor of a curriculum that considered the sociocultural dimensions of sciences, that is, a curriculum that takes into account the impact of the progress promoted by this knowledge and its applications in life, society, and culture of each person. In this regard, Hurd states that the Science curricula, in the 1950s and 1960s, emphasized the "understanding of classical structures, scientific disciplines and their way of investigation"⁽¹⁴⁾ (p. 408).

Considering, therefore, the socioeconomic, cultural, civic, and practical reasons to be taken on a daily basis and as considered in the formulation of our BNCC, in its proposals for the development of specific skills by discipline, Díaz, Alonso and Mas⁽⁹⁾, mentioned scientific literacy as an activity that develops gradually throughout life. The authors consider that:

“...scientific literacy is the most important purpose of science teaching; these reasons are based on practical personal, practical social benefits for the culture itself and for humanity, which are obtained through the combination of two binary scales: individual / group and practical / conceptual, giving rise to the four indicated domains”⁽⁹⁾ (p. 3).

In the article “Science Teacher Education: reflections on continuing education”, Silva and Bastos⁽²²⁾, from UNESP Bauru, published in the Journal of Education in Science and Technology (2012), brought up some reflections on the continuing education of science teachers, addressing the following items: (i) aspects of current legislation and public policies aimed at the continuing education of teachers of basic education; (ii) teaching knowledge necessary for their professional training; (iii) continuing education for science teachers. In conclusion, the authors understand that a teacher professional development must take place through continuous institutional training, consisting of a work plan, so that it can develop effectively in the tasks as a mediator between the students’ interaction with the information obtained, way that the teaching-learning process takes place and are built by studies of consistent scientific knowledge.

Carvalho and Gil-Pérez⁽²³⁾ (p. 28) state in their book “The Formation of Science Teachers” that it is up to the teacher to question the views of science that are approached in school in a repetitive, dogmatic, and uncritical way, aiming at breaking with these simplisms about science teaching linked to common sense. According to the aforementioned authors, the training of science teachers (both initial and continuing) should “know and question the teaching thinking of ‘common sense’” (...) As an example, question the simplistic view of what science and scientific work is. Question the way in which problems are focused, practical work and the introduction of concepts”.

It is, therefore, essential that a teacher understands the various contemporary demands, perceives his role as an agent of transformation, and, consequently, stimulates the students, considering their specificities in perceiving, discussing, and looking for solutions to the social reality in which they are inserted, and to perform this task, the articulation of teaching knowledge is necessary⁽²⁴⁾, as well as, according to Shulman⁽⁵⁾ (1986), teachers who have knowledge of specialized content and thus, will be protagonists of a construction that he calls “the pedagogical knowledge of content” and it must be articulated and not juxtaposed, meaning that form and content are not separated.

Facing a scenario full of new demands from this, in addition to a good training in basic education (Elementary I and II) and high school, a formation that allows future science teachers and those who are already in classes to practice their priesthood according to premises of the new curricular basis and continuing teachers’ education, an opening to the new and challenging teaching and learning process, like BNCC, is mandatory.

As for scientific research involving teaching about the human body in basic education, no relevant and experienced work has been found. There were also no articles dealing with curricular alignment in teacher education in human body issues and science curriculum, specifically addressing the theme of the human body in elementary and basic education.

The changes proposed by the BNCC⁽²⁾ have been directly impacting the entire school community, including the school administrators and the pedagogical team, coordinators, and advisors, who will be fundamental both when making adjustments and revisions of the school political pedagogical project, as for the curricular adjustments and either the construction or offers of pedagogical itineraries.

Regarding to future science teachers, specifically, they might not be proficient and confident enough in teaching all the competencies and abilities required in the Brazilian official regulation, and there is still no research on mastering and confidence to use such abilities, neither on scientific literacy of them involving the human body, neither if they, in their formation, were trained for these concepts, in their basic education, elementary school I and II or even in high school. It is important to note that most science teachers did not have initial or continuing

training to master scientific concepts about the human body, but they are still obliged to provide and guarantee their students' learning.

The preparation of science teachers is nowadays recognized as the critical point in the reform of science education.⁽²⁵⁾ At the moment, in Brazil, this topic is on the agenda of all discussion on the improvement of teaching and there is a great concern in this area, evidenced by the growing interest in research with initial and continuing teacher education. According to Carvalho (1995), from the reading that is made about the elementary school, some questions are emphasized, such as: memorization, the descriptive aspects of the concrete reality, the increasing distance from the students' daily life and interests, and the understanding of science as an unhistorical process, coated with an alleged neutrality. In the images that are made to identify the most immediate causes of the situation in which the public school in Brazil is today, they appear with enough evidence: the objective conditions of the teacher's work, which are, low wages, high workload of permanence in classroom, classes with an excessive number of students and the necessity to work in more than one school complete the workload; the inadequate training of teachers, through courses that are not effective concerning to minimal possibilities of instrumentalization for a teaching practice, both with regard to knowledge and with regard to pedagogical knowledge; the lack of diverse and good quality didactic material available to the teacher show a very difficult realia which will not change with the simple implementation of BNCC itself.

Teachers training courses, in the evaluation of Garrido, Castro and Carvalho (1995), both those designed for their preparation and those aimed at updating them, have been considered unsatisfactory. The non-integration between the University with the elementary and secondary schools, theoretical studies and teaching practice have been pointed out by researchers in science education, worldwide, as some of the causes, among others, of this inefficiency. A reason commonly remembered is the separation between researchers who think and propose innovative projects and teachers, who, as consumers, are not called to reflect systematically on teaching to modify their performance and to adapt innovative proposals.⁽²⁶⁾

Furthermore, according to Caldeira (1993), most of the knowledge that teachers receive in initial or permanent training courses, although they might be legitimated academically, are not produced, or legitimized by teaching practice. The contents and the way of developing them were defined from the outside, which explains the external relationship that teachers establish with them. Viana et al., cited by Carvalho (1992) highlights a major problem in our reality. The vast majority of teachers in state and municipal schools are being trained in colleges of low educational standard, being necessary, almost immediately after their immersion in the labor market, to be updated. Undergraduate courses have trained teachers who are very unprepared in relation to science content and in its general preparation, with serious consequences for the teaching process.

Complementing the author's cited previously thinking, we cannot expect, for example, that a teacher with a precarious mastering in the theme of the human body, would be succeed in teaching in an orientation in which the negotiation of meanings is of a fundamental importance. Continuing education courses are also justified for those professionals from reputable universities, as it would be illusory to think that they arrive at the classroom with high levels of teaching competence. The atrophy of the theoretical foundations of teacher training courses and the consequent atomization and fragmentation of the curricula is also a reality in good Universities, according to the same authors. Therefore, continuing education courses have the role, among us, not only to ensure the updating of teachers, but also to address deficiencies in training courses.

As it was pointed by Cunha and Krasilchik (2000), with regards to teachers' courses in biological sciences, whether they are linked to the under graduation or not, including here also well-recognized courses from the best Universities in Brazil, they are far from adequately being trained as science teachers for basic education. Likewise, it occurs in courses in Physics and Chemistry, also due to the concentration of disciplines in their specific areas. Insisting that the Biology, Chemistry or Physics courses prioritize the training of science teachers has been a battle for teacher educators, but the priority in these courses is not this, especially when the course also presents the bachelor's degree. The solutions offered by short courses have aggravated the situation, launching professionals with a deficient

background in several directions. As for the teacher of the first cycles of elementary education (1st to 4th grades), the situation is even more complex, but it is believed that this teacher should continue to be trained in Pedagogy courses – qualifications for teaching.⁽²⁷⁾

The Common Core National Standards – BNCC (2017) is the way found by the Brazilian authorities to design a common curriculum for all schools in the country. The Brazilian normative for elementary education was enacted in 2017, became mandatory for the entire national territory in 2020 and was expected to be implemented in schools by the beginning of 2021. The basic premise of BNCC in its theme “Life and Evolution” is the proposal of the study of issues related to living beings (including human beings), their characteristics and needs, and life as a natural and social phenomenon, the essential elements for its maintenance and understanding of the evolutionary processes that generate the diversity of life forms on the planet, based on the study of the characteristics of eco systems and highlighting the interactions of living beings and non-living factors, with special attention to the relations of human beings with the environment.⁽²⁾

Basic education is composed in the Brazilian education system of Fundamental I, which covers from the first to the fifth year, and Fundamental II, which comprises the two initial grades, sixth and seventh years, and two final grades, eighth and ninth years. In the initial years, already as in the premises of BNCC in its thematic unit “Life and Evolution”, it is proposed to study the issues related to their living beings and their characteristics, through the various abilities listed, which must be worked on throughout the cycle of basic education, then covering the grades of Fundamental I and Fundamental II.

In addition to the focus on the perception of the human body, in its thematic “Natural Sciences – Elementary Education”, BNCC emphasizes aspects related to health, understood not only as a state of dynamic balance of the body, but as for the community, “Opening space to discuss what is needed to promote individual and collective health, including within the scope of public policies”.⁽²⁸⁾

In the early years of Fundamental II, in continuity with the approaches of early childhood education (Fundamental I), the BNCC strongly suggests in the indication of a pedagogical approach in which children should expand their knowledge and

appreciation for the body, identify the necessary care for maintaining the health and integrity of the organism and develop attitudes of respect and acceptance for individual differences, with respect to both ethnic-cultural diversity and in relation to the inclusion of special education students.⁽²⁸⁾

Since BNCC (2017) intends students, when they have finished elementary school, should be able to understand the organization and functioning of their own bodies, as well as to interpret the physical and emotional changes that accompany adolescence, recognizing the impact they have, can influence in the self-esteem and in the safety of their own body, in the final years of Fundamental II, issues related to human reproduction and sexuality must also be addressed, subjects of great interest and social relevance in this age group, as well as knowledge about health issues, basic sanitation, air quality and nutritional conditions of the Brazilian population.⁽²⁾

Henceforth, for this research, based on the parameters recommended by the BNCC for the study of the human body, twenty abilities related to its knowledge and its health were chosen properly, as shown in Tables 1, 2 and 3, presented as follows:

Table 1 – BNCC Abilities – Human Body – Elementary School I – 1st to 5th Grade

	BNCC code	DESCRIPTION	ABILITY
1st Year	EF01CI02	GENERAL ANATOMY	Locate, name and graph (by means of drawings) part of the human body and explain its function.
	EF01CI03	BODY HYGIENE	Discuss the reasons why the body's hygiene habits (washing hands before eating, brushing teeth, cleaning eyes, nose, and ears etc.) are necessary for keeping health.
	EF01CI04	ANATOMICAL DIVERSITY	Compare physical characteristics between colleagues, recognizing diversity and the importance of valuing, welcoming and respecting differences.
3rd Year	EF03CI05	EMBRYOLOGY AND EVOLUTION	Describe and communicate the changes that occur since birth in animals from different terrestrial or aquatic environments, including human being.
5th Year	EF05CI06	DIGESTIVE AND RESPIRATORY SYSTEM	Select arguments that justify why the digestive and respiratory systems are considered co-responsible for the body's nutrition process, based on the identification of the functions of these systems.
	EF05CI07	CARDIOVASCULAR SYSTEM	Justify the relationship between the functioning of the circulatory system, the distribution of nutrients throughout the body and the elimination of waste produced.
	EF05CI08	NUTRITION AND HEALTH	Organize a balanced menu based on the characteristics of the food groups (nutrients and calories) and the individual needs (activities performed, age, sex etc.) to maintain the health of the organism.
	EF05CI09	NUTRITIONAL DISORDERS	Discuss the occurrence of nutritional disorders (such as obesity, malnutrition etc.) among children and young people based on the analysis of their habits (types and amounts of food eaten, physical activity etc.).

Source: by the author, 2022.

Table 2 – BNCC Abilities – Human Body – Elementary School II – 6th and 7th Grades
(Initials)

	BNCC code	DESCRIPTION	ABILITY
6th Year	EF06CI06	SYSTEMS ORGANIZATION	Make conclusions based on the analysis of illustrations and / or models (physical or digital), that organisms are a complex arrangement of systems with different organizations.
	EF06CI07	SENSORIAL AND MOTOR PHYSIOLOGY	Justify the role of the nervous system in the coordination of motor and sensory actions of the body, based on the analysis of its basic structures and respective functions.
	EF06CI08	VISION AND ITS DISEASES	Explain the importance of vision (capture and interpretation of images) in the interaction of the organism with the environment and based on the functioning of the human eye, select suitable lenses to correct different vision defects.
	EF06CI09	LOCOMOTION STRUCTURE AND CONTROL	Deduce that the structure, support, and movement of animals result from the interaction between the muscular, bone and nervous systems.
	EF06CI10	NERVOUS SYSTEM AND PSYCHOACTIVE SUBSTANCES	Explain how the functioning of the nervous system can be affected by psychoactive substances.
7th Year	EF07CI09	PUBLIC HEALTH POLICY INDICATORS	Interpret the health conditions of the community, city, or state, based on the analysis and comparison of health indicators (such as infant mortality rate, basic sanitation coverage and incidence of water and airborne diseases, among others) and the results of public policies aimed at health.
	EF07CI10	VACCINATION	Discuss about the importance of vaccination for public health based on information about the way the vaccine works in the body and the historical role of vaccination for the maintenance of individual collective health and the eradication of diseases.

Source: by the author, 2022.

Table 3 – BNCC Abilities – Human Body – Elementary School II – 8th and 9th Grades (Finals)

	BNCC CODE	DESCRIPTION	ABILITY
8th Year	EF08CI07	REPRODUCTION EVOLUTION	Compare different reproductive processes in plants and animals in relation to adaptive and evolutionary mechanisms.
	EF08CI08	PUBERTY TRANSFORMATIONS	Analyze and explain the changes that occur during the puberty considering the role of sexual hormones and the nervous system.
	EF08CI09	CONTRACEPTIVE METHODS	Compare the way of action and the effectiveness of the various contraceptive methods and justify the need of sharing the responsibility in choosing and using the most appropriate method for preventing early and unwanted pregnancies and Sexually Transmitted Infections (STIs).
	EF08CI10	ISTs – SEXUALLY TRANSMITTED INFECTIONS	Identify the main symptoms, ways of transmission and treatment of some STDs (with an emphasis on SIDA) and discuss prevention strategies and methods.
	EF08CI11	HUMAN SEXUALITY	Select arguments that highlight the multiple dimensions of human sexuality (biological, sociocultural, affective, and ethical).
9th Year	-	-	No Abilities

Source: by the author, 2022.

As it is shown below, the UC CHEF involves basic principles of anatomy, histology, and physiology in a total workload of a 72 hours course. It adopts active learning methodologies in all classes and the activity “Investigating Physiology” is one of the activities of formative assessment that make up the students’ portfolio. To pass the UC, students are assessed for grades obtained in portfolio activities, two traditional tests and a seminar. The evaluation process occurs as follows:

- *Formative Assessment* – 60 points – Through the project-based learning methodology, students should perform a research project of biological analyzes collected by smartphones or instruments of variable detection methods (e.g., a thermometer) being the experiments with smartphones that would guarantee the highest rating. The final project worths 20 points. It is an individual assessment. Through the methodology of the remembering practice, students should respond to

quiz-portfolios asynchronously referenced to previously available video lessons. One final grade for the quiz-portfolios values 20 points, and each of the students score is equal to the number of quiz-answer questions correctly answered divided by the total number of questions from all the quiz-portfolios of the UC. This assessment is individual. A concept map should be delivered in four stages: initial, intermediate I, intermediate II and final, and the ability of group members to aggregate concepts learned in class are evaluated through the conceptual map that ought to address the central theme: COVID-19. This evaluation is in a group containing a minimum of three and a maximum of five members.

- *Summative assessment* – 15 points – By means of a classic test made available in advance and with a period of 48 hours to be responded, students were tested as to how much knowledge is known in the UC. There were three tests worth five points each.

- *Engagement rating* – 25 points – Through activity completion data, students were presented with regards to engagement in the execution of the activities proposed by the teacher. Among the activities available, RETEACH, where the students must indicate in a form the two contents that had most doubts about the material from the asynchronous activities available during the week. The student's final assessment is equal to the number of completed activities divided by the total number of activities made available. The maximum attempt to be achieved is 25 points.

For the “fulfilled” criterion or criteria obtained, the final calculation is equal to the superior 60 points in the final sum of the points obtained in the *formative assessment*, *summative assessment*, and *engagement assessment*.

The UC is often identified as one of the most difficult UCs of the semester and is a part of the basic cycle of the Science-Degree course at UNIFESP, when students have not yet chosen to follow one of the possible trajectories to obtain qualification for teaching biology, physics, chemistry, or mathematics. Tables 4 and 5 above show the UC CHEF in detail.

Table 4 below shows the UC human body teaching plan, structure, and function as it was taught in remote format, in which this researcher participated as a trainee student as a part of the Didactic Improving Program (PAD-UNIFESP).

Table 4 – Curricular Unit: Human Body – Teaching Plan, Structures and Functions

Professor: CAMILO DE LELLIS SANTOS (Biological Sciences Department)	Collaborating Professor(s): NILANA TENÓRIO DE BARROS (Biological Sciences Department) LIGIA AJAIME AZZALIS (Exacts and Earth Sciences)
2 nd Semester 2021	72 hours in 15 weeks of remote classes.
MONITORS AND TRAINEES' STUDENTS FROM THE DIDACTIC IMPROVEMENT PROGRAM (PAD-UNIFESP)	On <u>Wed afternoon</u> , Group B : Julia Ferreira, Aianne Souto, Kaio Macedo e Luana Maciel, on <u>Wed evenings</u> , Group D : Julia Ferreira, Taysa Bassani, Emanuel Almeida, Luana Maciel e Thais Santos, on <u>Thu afternoon</u> , Group A : Julia Ferreira, Kaio Macedo e Thais Santos and on <u>Thu evenings</u> , Group C : Julia Ferreira, Gilberto Paiva , Anderson K. Ueno, Luana Maciel, Thais Santos e Sandro Tonin.
SYLLABUS	Fundamentals of Anatomy, Histology and Physiology of the human body. Anatomical Terminologies, Homeostasis, Cell Electrophysiology. Fundamental Human Tissues, Morphophysiological features of the locomotor system, Morphophysiological characteristics of the nervous system, Morphophysiological characteristics of the endocrine system, Morphophysiological characteristics of the cardiovascular system. Morphophysiological characteristics of the respiratory system. Morphophysiological characteristics of the digestive system. Morphophysiological characteristics of urinary system. Morphophysiological characteristics of reproductive systems. Strategies for teaching about the human body.
GENERAL GOALS	Understand how the structural organization of cells and tissues contributes to the physiological processes of the human body and integrate the homeostasis phenomena.
SKILLS AND COMPETENCIES	Learning about the structural and functional organization of the body's biological human systems; development of critical thinking and cognition to discuss about the impact of physical and chemical variables and psychosocial determinants in the steady state of the human body; consolidation of scientific concepts about the anatomy, histology and physiology of the human body and creativity development aiming the application and creation of didactic practices about the human body.
TEACHING METHODOLOGY	<ul style="list-style-type: none"> • The synchronous activities occurred mostly via Zoom or eventually via Google Meet (links available in Moodle). • The practices of active learning methodologies were carried out using the software/applications: Socrative for peer instruction and cMap tools for conceptual maps; • Practical histology classes were hold throughout virtual slides available at https://cps.med.ubc.ca/virtual-histology/ and http://www.histologyguide.com/index.html • Practical physiology classes were hold using the MobLeLabs methodology (Mobile Learning Laboratories) according to: LELLIS-SANTOS, CAMILO & ABDULKADER, FERNANDO. Smartphone-assisted experimentation as a didactic strategy to maintain practical lessons in remote education: physiology education during the COVID-19 pandemic. Advances in Physiology Education, 21: 579-586, 2020

Source: UC CHEF, UNFESP, Professor Camilo de Lellis Santos, 2020.

Table 5 below shows the UC human body schedule and conceptual plan as it was taught in a remote format.

Table 5 – Curricular Unit: Human Body, Schedule, and Conceptual Planning

WEEK	GENERAL CONTENTS	ASYNCHRONOUS CONTENT (Video Classes)	SYNCHRONOUS CONTENTS	WORKLOAD
1 st , 18-21, November. Prof. Camilo	UC Introduction Fundamentals Homeostasis	UC Tutorial Survey questionnaires of prior knowledge.	Homeostasis	4
2 nd , 23-28, November Prof. Camilo	Introduction to studies in morphology, histology of fundamental tissues.	HE staining technique for an epithelial tissue, connective tissues, muscle tissues, nervous tissue, Quiz-Portfolio Intro to histology, RETEACH.	Retrieval practices, anatomical plans and cuts, Histology Practice: intestine and mouse paw. Starting the COVID 19 Conceptual Map.	5
3 rd , 30 th November, 05 th December. Prof. Camilo	Bioelectrogenesis	Transport across the membrane, membrane potential, action potential, Bioelectrogenesis Portfolio Quiz RETEACH	Retrieval practice, Practice simulator of membrane potential Starting the Project investigating the Human physiology	5
4 th , 07-12 December Prof. Camilo	Neurophysiology	Anatomy of the Nervous System CNS histology Synapse Physiology Neurophysiology Portfolio Quiz RETEACH	Retrieval practice Integration Game Neuronal and Cerebellar slide	5
5 th , 14-19 December Prof. Camilo	Sensorial and Motor Physiology	Sensorial Physiology, Motor Systems, Physiology Portfolio Quiz Sensorial and motor RETEACH	Retrieval practice, sensorial physiology practice with a familiar member (cortex functional areas, arc reflex, receptor field and sensorial adaptation).	5
6 th , 21-22 December Prof. Camilo	Midterm evaluation	Exam II via Moodle	No synchronous Classes, Questions & Aswers about investigating the human physiology project via forum or WhatsApp.	3
7 th , 04-09 January Prof. Camilo	Human growth and Motricity.	Bone anatomy and histology Growth, Bony remodeling, Muscle Histology, muscular contraction, Human Motricity Portfolio Quiz RETEACH	Retrieval practice, Bone morphology practice Video lessons, Portfolio Quiz, Investigating the Human physiology project opinion issuance.	5

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WEEK	GENERAL CONTENTS	ASYNCHRONOUS CONTENT (Video Classes)	SYNCHRONOUS CONTENTS	WORKLOAD
8 th , 11-16 January Prof. Nilana	Respiratory System	Video lessons, reasons, and reactions in the breathing system in physiological conditions, effects of Sars-Cov2 on the human respiratory system, Quiz-Portfolio	Development I of the Conceptual Map COVID-19, Breaking through centers of scientific information on this theme.	5
9 th , 18-23 January Prof. Nilana	Gastrointestinal Physiology	Video Lessons, Life Feeding, Understanding the body mechanisms to transform and survive, Portfolio Quiz	Practice enzymatic digestion, Breaking through centers of scientific information on this theme.	5
10 th , 25-30 January Prof. Lígia	Blood, one integrator tissue	Video lessons / Text reading Blood components and their functions. Hemostasis. Portfolio Quiz, Tissue histology practice blood.	Development 2 of the conceptual COVID-19 Map	5
11 th 01-06 February Prof. Camilo	Cardiovascular Physiology	Cardiovascular anatomy and histology, Electrical activity in the heart, Blood pressure, Practice the dance of cardiac rhythm, Cardiovascular Portfolio Quiz RETEACH	Retrieval practice, Learning practices based on art. Artery slides vs veins.	5
12 th , 08-13 February Prof. Camilo	Endocrine Physiology	Mechanisms of hormonal action, Hypothalamus-Pituitary Axis, Gland Physiology Portfolio Quiz Endocrine, RETEACH	Retrieval practice Hormone Practice vs. Gland, Development of project investigating the human physiology	5
13 th , 15-20 February Prof. Camilo	Neuroendocrine Integration	Neuroendocrine Integration, Physiology book chapter the Thyroid, Quiz-Portfolio biological rhythms, RETEACH	Retrieval practice Practice the case of Thyroid hormones	5
14 th , 22-27 February Prof. Camilo	Reproduction physiology	Male Reproductive System Female Reproductive System Quiz-Portfolio Reproductive Systems RETEACH	Retrieval practice, Physiology of the sexual act, Practice Sexes Game.	5
15 th 01-03 March. Prof. Camilo e Lígia	Urinary System Final summation evaluation	Video lessons/Text reading Urinary System: components and their role in shaping the urine and blood pressure arterial. Final Test via Moodle	Review and UC ending, Conceptual COVID 19 Map Completion.	5

Source: UC CHEF, UNFESP, Professor Camilo de Lellis Santos, 2020.

2 HYPOTHESES

2.1 H1

Students in initial training for science teaching can acquire concepts and abilities related to the human body if they are exposed to an active learning-based course focused on human anatomy and physiology.

2.2 H2

If an undergraduate course is well structured to provide learning about the human body, then science teachers in initial training would be more confident in teaching the abilities related to the human body as determined in the Brazilian Common Core National Standards BNCC.

3 OBJECTIVES

3.1 General objective

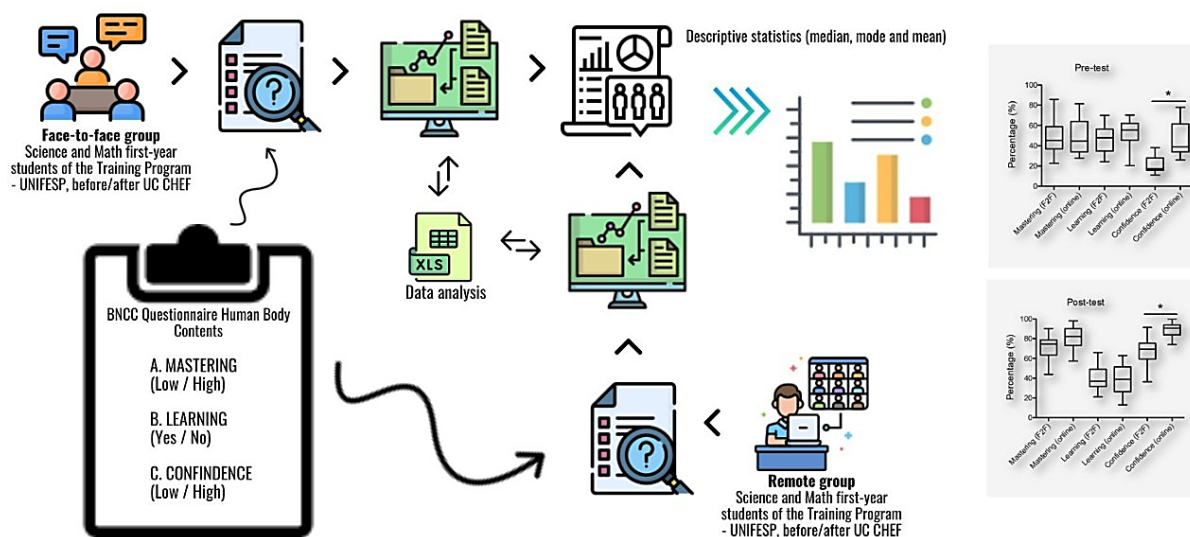
Understanding the level of scientific knowledge about the BNCC abilities related to the human body content and its relationship with the initial training of future science teachers (first-year students who have not yet taken courses in anatomy, histology, and physiology).

3.2 Specific objectives

- Identifying whether the participants were previously exposed during basic education to learning situations involving the BNCC abilities related to the human body.
- Checking if the mastering and confidence of students in initial training of science teachers to teach BNCC abilities related to the human body would change after taking an undergraduate course in anatomy and physiology.
- Promoting the enrichment of scientific literature on the methodology of training science / biology teachers, enabling them to teach about the human body.
- Investigate the impact of modality of teaching (face-to-face or remote) on the mastering and confidence of undergraduate students exposed to a human body course.

4 METHODOLOGY

This study has the characteristics of quantitative and qualitative educational research, as it can be seen in Figure 1. Briefly, first-year students of the Science and Mathematics Teacher Training Program from UNIFESP – Universidade Federal de São Paulo (face-to-face and remote group) answered a questionnaire-type inventory at the beginning and at the end of the UC CHEF containing all BNCC abilities related to the human body content. Students were subsequently exposed to learning anatomy, histology, and physiology according to the curricular program offered by the course curricular unit (UC) Human Body: Structure and Function (CHEF). At the end of the UC, the same cohort of students was invited to answer the same inventory of abilities, to allow a comparison between the previous knowledge and the impact of the UC on student's learning. The data were tabulated and analyzed using media, mode and mean in a XLS software.



Source: by the author, 2022.

Figure 1 – Study design.

4.1 Populational Study and analysis tool

The study educational population was composed of students entering the second semester of 2019 at UC CHEF face to face classes (N=82) and also in 2020 in the same UC CHEF remote classes (N=54). Students responded to the BNCC abilities inventory on the first day of classes. As the inventory was not a mandatory activity, not all enrolled students responded. After completing the discipline, face to face and remotely, students were asked to answer the same abilities inventory.

The students' data who agreed to participate in this research were compiled if an agreement was given by them informed in the consent form. This study was analyzed and approved by the Institution Review Board of UNIFESP, and it was registered in two records, one for research related to the UC studied (CAAE: 14020419.0.0000.5505) and another for the research related to the curricular alignment of teacher education with the BNCC (CAAE: 31106920.5.0000.55 05).

The analysis instrument, as previously cited (appendix 2), was an inventory of abilities created purposely to collect information from the students about their content knowledge of human body presented in BNCC abilities' list for primary school, known in the Brazilian educational system as "Fundamental I" and "Fundamental II". For each ability, students answered the following questions:

A) Do you master the fundamental concepts of that ability?

B) Did you learn this ability in primary and secondary education (elementary to high school)?

C) If you were asked to teach this ability today to a primary or secondary education student, how confident would you feel?

The questionnaire items were presented on a 3 to 4 points *Likert* scale, where scale to question A varied from "nothing" to "a lot", scale to question B included "yes", "no" and "I don't remember", and scale to question C varied from "not confident" to "very confident" plus "I don't know".

It was also obtained an inventory collecting information about age, gender, area of interest to pursue in teaching (biology, chemistry, physics, or mathematics), type of school (public or private), and extra courses to prepare for post-secondary education, known in Brazil as "cursinho pré-vestibular".

4.2 Data analysis

Responses to questionnaires on a *Likert scale* are expressed as a percentage and analyzed as mean and mode for comparative purposes. The three main questions for each ability were named:

- *MASTERING*, which would reflect how dominant the students were concerning one specific ability. The scale varied from 1, representing “nothing”, to 4 representing “a lot”. For analysis purposes, points 1 and 2 were grouped as low dominance, and points 3 and 4 were grouped as high dominance.

- *LEARNING*, which would reflect whether the student has learned a certain ability in primary and secondary education. Answers “Yes” and “No” were coded as 1 and 2, respectively.

- *CONFIDENCE*, which should reflect how confident the students were in teaching a certain ability if they were asked for. The scale varied from “not confident” (1) to “confident” (2) and “very confident” (3). For analysis purposes, points 2 and 3 were grouped as confident.

Data were analyzed and presented as mean, considering the standard deviation. The significance level was adopted at $p < 0.05$. The Shapiro-Wilk normality test was applied to check for normal distribution of the samples and to support the choice of suitable statistical test. Comparative analysis between pre and post-intervention for mastering and learning were performed using the One-way ANOVA test followed by Tukey’s multiple comparison test. Comparative analysis between pre and post-intervention for confidence were performed using the Kruskal-Wallis’s test followed by Dunn’s multiple comparison test.

5 RESULTS AND DISCUSSION

The collected data reveal aspects that deserve analysis for better planning of teacher education at initial levels and professional development. It is taken globally and believed everywhere that adequate teacher training serves as a foundation to build more competent, ethical, and humanized education, and our results can favour educational policies as an indicator for evidence-based education.

How does teachers' knowledge of science content change over their professional careers? According to Hanna J. Arzi, research into this question is not abundant and studies on science teachers' knowledge of subject matter have usually been limited to the preservice period, more often done with elementary rather than secondary student-teachers, and only a few continued through the early career years.^(29,30)

5.1 Sociodemographic data

The socioeconomic data analyzed corresponds to a study done with students from science (Biology, Physics and Chemistry) and mathematics education courses at UNIFESP, whose main objective was evaluating the undergraduate students' prior knowledge in relation to the human body. It is an observational resource, involving a convenience sample. The cohort studied for the first group (face-to-face) is composed of 82 (originally N=93) students before the UC for the face-to-face questionnaire and 54 (originally N=54) for the remote questionnaire. It was noticed that both groups were very similar.

The observed variables were general data referring to class, sex, age, education (public school, private school, public / private school), preparatory course ("cursinho pré-vestibular", as it is said in Brazil), questions about previous knowledge of physiology and human body in basic education when compared with the abilities provided for basic education in BNCC, meaning to analyze and describe the students profile who participated in the research and answered the questionnaires about the perception they acquired concerning to the human body during their basic education.

The following data, on table 06, depicts the sociodemographic information of our cohort profile. The students' average age in the face-to-face group was 22.7 years old (standard deviation of 8.5), varying between 18 and 59 years old. Eleven individuals did not inform their age when completing the questionnaire. Similar numbers were observed among students who had answered the remote questionnaire concerning to the average and the standard deviation, even though all of them had informed their ages.

Table 6 – Sociodemographic data

The following data depicts the sociodemographic profile of our cohort.

Face-to-face			Remote		
AGE					
	N	%		N	%
18-19 y/o	24	29,27	18-19 y/o	15	27,78
20-24 y/o	29	35,36	20-24 y/o	19	35,18
25-30 y/o	8	9,76	25-30 y/o	7	12,96
>30 y/o	6	7,31	>30 y/o	13	24,08
Not informed	15	18,3	Not informed	0	0
Total	82	100	Total	54	100
GENDER					
Male	36	43,9	Male	25	46,3
Female	39	47,56	Female	29	53,7
Not informed	7	8,54	Not informed	0	0
Total	82	100	Total	54	100
SCHOOLING					
Public	41	50	Public	32	59,26
Public/Private	17	20,73	Public/Private	10	18,52
Private	19	23,17	Private	12	22,22
Not informed	5	6,1	Not informed	0	0
Total	82	100	Total	54	100
PREPARATORY COURSE					
Yes	37	45,12	Yes	17	31,48
No	39	47,56	No	37	68,52
Not informed	6	7,32	Not informed	0	0
Total	82	100	Total	54	100
AREA OF INTEREST					
Biology	37	45,12	Biology	26	48,15
Chemistry	14	17,07	Chemistry	9	16,66
Physics	18	21,95	Physics	8	14,81
Mathematics	6	7,32	Mathematics	11	20,38
Not informed	7	8,54	Not informed	0	0
Total	82	100	Total	54	100

Source: by the author

For the face-to-face group, out of eight two (N = 82) students, 47.56% (39) were female and 43.90% (36) were male; 8.54% (7) individuals did not identify their gender. On the remote questionnaire, out of fifth four (N = 54) students, 53.70% (29) were female, 46.30% (25) were male, meaning that all of them identified their gender.

Regarding the type of school, on the face-to-face group 50.00% (41) come from public schools, only 20.73% (17) from public and private schools and 23.17% (19) from private schools only; 6.10% (5) did not answer. On the remote questionnaire 59.26% (32) come from public schools, only 18.52% (10) from public and private schools and 22.22% (12) from private schools. All of them answered the questionnaire.

When asked about enrolment in extra course to prepare for post-secondary education admission, known in Brazil as “cursinho pré-vestibular”, on the face-to-face group 45.12% (37) students reported having taken a pre-university course, 47.56% (39) reported not having taken a pre-university course and 7.32% (5) did not. In the remote group 31.48% (17) reported having taken a pre-university course, 68.52% (37) reported not having taken a pre-university course.

Considering that the students will graduate as science teachers with credentials to teach some specific subject of science and mathematics, we decided to identify their preferred area of interest to pursue in teaching. The face-to-face group pointed that most students (45.12%) intend to follow the qualification in Biology (37), 17.07% (14) in Chemistry, 21.95% (18) in Mathematics, 7.32% (6) in Physics, 8.54% (7) did not identify the area of interest. On the remote questionnaire all students answered, and most of them (48.15%) intend to follow the qualification in Biology (26), 16.66% (09) in Chemistry, 14.81% (8) in Mathematics and 20.38 % (6) in Physics.

5.2 Quantitative study

The following tables present an overview of the students' responses referring to MASTERING, LEARNING and CONFIDENCE in teaching regarding to all 20 abilities related to human body in BNCC.⁽²⁾

Table 7 presents the descending list of the abilities from high to low mastering by the students before and after the exposure to the UC content during face-to-face teaching. The interval of low mastering in the first classified ability (EF06CI08 – VISION AND ITS DISEASES) in the face-to-face group is from 77.17% before the UC to 40.74% after the UC. In the same group, after exposure to the UC, the interval of high mastering in the first classified ability (EF01CI04 – ANATOMICAL DIVERSITY) changed from 85.87% to 90.25%.

Table 7 – Mastering Face to Face, Low and High, Pre and Post UC

MASTERING - FACE-TO-FACE - LOW				MASTERING - FACE-TO-FACE - HIGH			
PRE	%	POST	%	PRE	%	POST	%
EF06CI08	77,17	EF03CI05	56,09	EF01CI04	85,87	EF01CI04	90,25
EF06CI07	67,38	EF08CI07	43,20	EF01CI03	81,71	EF01CI03	88,88
EF05CI07	64,52	EF07CI09	41,76	EF08CI09	75,82	EF07CI10	88,75
EF08CI07	63,73	EF05CI08	40,74	EF07CI10	70,32	EF01CI02	79,26
EF03CI05	63,44	EF06CI08	38,75	EF08CI10	60,43	EF08CI09	79,00
EF01CI02	63,04	EF06CI09	29,63	EF05CI06	53,76	EF08CI11	78,21
EF06CI10	57,14	EF06CI10	28,75	EF06CI06	51,08	EF05CI07	76,55
EF08CI08	57,13	EF08CI10	26,59	EF05CI09	51,07	EF05CI09	76,53
EF05CI08	56,03	EF08CI08	26,58	EF08CI11	47,24	EF05CI06	75,31
EF06CI09	55,43	EF06CI07	25,92	EF07CI09	45,55	EF06CI06	75,00
EF07CI09	54,43	EF06CI06	25,00	EF06CI09	44,55	EF06CI07	74,08
EF08CI11	52,74	EF05CI06	24,69	EF05CI08	43,94	EF08CI08	73,41
EF06CI06	48,91	EF05CI07	23,45	EF06CI10	42,85	EF08CI10	73,41
EF05CI09	48,90	EF05CI09	23,45	EF08CI08	42,85	EF06CI10	71,25
EF05CI06	46,24	EF08CI11	21,79	EF01CI02	36,96	EF06CI09	70,37
EF08CI10	39,55	EF08CI09	20,98	EF03CI05	36,56	EF06CI08	61,25
EF07CI10	29,66	EF01CI02	20,73	EF08CI07	36,26	EF05CI08	59,26
EF08CI09	24,16	EF07CI10	11,25	EF05CI07	35,48	EF07CI09	58,22
EF01CI03	18,28	EF01CI03	11,10	EF06CI07	32,62	EF08CI07	56,78
EF01CI04	14,13	EF01CI04	9,75	EF06CI08	22,82	EF03CI05	43,91

Table 8 – Demonstrates the five first abilities cited as Low and High in the previous table 7, concerning Mastering Pre and Post UC CHEF, Face to Face group

LOW MASTERING – FACE TO FACE – PRE UC CHEF		
1st	EF06CI08	VISION AND ITS DISEASES
2nd	EF06CI07	SENSORIAL AND MOTOR PHYSIOLOGY
3rd	EF05CI07	CARDIOVASCULAR SYSTEM
4th	EF08CI07	REPRODUCTION EVOLUTION
5th	EF03CI05	EMBRYOLOGY AND EVOLUTION
HIGH MASTERING – FACE TO FACE – PRE UC CHEF		
1st	EF01CI04	ANATOMICAL DIVERSITY
2nd	EF01CI03	BODY HIGIENE
3rd	EF08CI09	CONTRACEPTIVE METHODS
4th	EF07CI10	VACCINATION
5th	EF08CI10	SEXUALLY TRANSMITTED INFECTIONS
LOW MASTERING – FACE TO FACE – POST UC CHEF		
1st	EF03CI05	EMBRYOLOGY AND EVOLUTION
2nd	EF08CI07	REPRODUCTION EVOLUTION
3rd	EF07CI09	PUBLIC HEALTH POLICY INDICATORS
4th	EF05CI08	NUTRITION AND HEALTH
5th	EF06CI08	VISION AND ITS DISEASES
HIGH MASTERING – FACE TO FACE – POST UC CHEF		
1st	EF01CI04	ANATOMICAL DIVERSITY
2nd	EF01CI03	BODY HYGIENE
3rd	EF07CI10	VACCINATION
4th	EF01CI02	GENERAL ANATOMY
5th	EF08CI09	CONTRACEPTIVE METHODS

Source, by the author 2022.

Table 9 presents the descending list of the abilities that were learned by the students (answer YES) during primary and secondary education as stated in the face-to-face questionnaire before and after the UC.

Generally, students who answered NO stated that they learned the first ability classified EF08CI11 – HUMAN SEXUALITY in a range from 24.17% (before the UC) to 37.17% (after the UC).

Table 9 – Learning Face to Face, Yes or No, Pre and Post UC

LEARNING - FACE-TO-FACE			
PRE - YES	%	POST - YES	%
EF01CI03	69,89	EF01CI02	43,90
EF08CI08	65,93	EF01CI03	65,85
EF08CI09	62,63	EF01CI04	36,25
EF08CI10	60,43	EF03CI05	44,44
EF05CI08	58,24	EF05CI06	37,04
EF08CI07	57,14	EF05CI07	37,03
EF03CI05	53,76	EF05CI08	32,10
EF01CI02	52,68	EF05CI09	35,00
EF06CI09	52,17	EF06CI06	30,77
EF07CI10	50,54	EF06CI07	27,50
EF05CI06	49,46	EF06CI08	34,57
EF05CI07	46,24	EF06CI09	29,62
EF01CI04	46,23	EF06CI10	20,98
EF06CI06	43,47	EF07CI09	31,25
EF06CI07	41,30	EF07CI10	54,32
EF06CI08	36,95	EF08CI07	48,14
EF07CI09	36,66	EF08CI08	49,37
EF05CI09	33,69	EF08CI09	60,49
EF06CI10	27,47	EF08CI10	55,69
EF08CI11	24,17	EF08CI11	37,17

Table 10 – Demonstrates the five first abilities cited as YES and NO – Learning Pre and Post UC CHEF, Face to Face

LEARNING FACE TO FACE, YES, PRE UC CHEF		
1st	EF01CI03	BODY HYGIENE
2nd	EF08CI08	PUBERTY TRANSFORMATIONS
3rd	EF08CI09	CONTRACEPTIVE METHODS
4th	EF08CI10	SEXUALLY TRANSMITED INFECTIONS
5th	EF05CI08	NUTRITION AND HEALTH
LEARNING FACE TO FACE, NO, PRE UC CHEF		
1st	EF08CI11	HUMAN SEXUALITY
2nd	EF06CI10	NERVOUS SYSTEM AND PSYCHOACTIVE SUBSTANCES
3rd	EF05CI09	NUTRITIONAL DISORDERS
4th	EF07CI09	PUBLIC HEALTH POLICY INDICATORS
5th	EF06CI08	VISION AND ITS DISEASES
LEARNING FACE TO FACE, YES, POST UC CHEF		
1st	EF01CI02	GENERAL ANATOMY
2nd	EF01CI03	BODY HYGIENE
3rd	EF01CI04	ANATOMICAL DIVERSITY
4th	EF03CI05	EMBRYOLOGY AND EVOLUTION
5th	EF05CI06	DIGESTIVE AND RESPIRATORY SYSTEMS
LEARNING FACE TO FACE, NO, POST UC CHEF		
1st	EF06CI10	NERVOUS SYSTEM AND PSYCHOACTIVE SUBSTANCES
2nd	EF06CI07	SENSORIAL AND MOTOR PHYSIOLGY
3rd	EF07CI09	PUBLIC HEALTH POLICY INDICATORS
4th	EF06CI09	STRUCTURE AND LOCOMOTION CONTROL
5th	EF05CI09	NUTRITIONAL DISORDERS

Source, by the author, 2022.

Table 11 presents the descending list from high to low confidence of teaching the abilities by the students according to the face-to-face group. Before exposure to the course, the interval of low confidence to teach the first ability classified (EF01CI02 – GENERAL ANATOMY) changed from 61.33% to 8.83%, that means a significant improvement in their confidence to teach. After the exposure to the UC content, in the same group, the interval of high confidence in the first ability classified (EF01CI03 – BODY HYGIENE) changed from 88.75% to 98.68%, showing an important improvement in teaching this ability either.

Table 11 – Confidence Face to Face, Low and High, Pre and Post UC

CONFIDENCE - FACE-TO-FACE				CONFIDENCE - FACE-TO-FACE			
PRE - LOW	%	POST - LOW	%	PRE - HIGH	%	POST - HIGH	%
EF01CI02	61,33	EF01CI02	8,83	EF01CI03	88,75	EF01CI03	98,68
EF01CI03	11,25	EF01CI03	1,32	EF01CI04	87,34	EF01CI04	94,74
EF01CI04	12,66	EF01CI04	5,26	EF08CI09	76,19	EF08CI09	94,29
EF03CI05	62,03	EF03CI05	47,28	EF07CI10	75,64	EF07CI10	91,90
EF05CI06	44,74	EF05CI06	17,40	EF08CI10	68,83	EF01CI02	91,17
EF05CI07	56,52	EF05CI07	17,64	EF05CI09	56,41	EF05CI09	88,40
EF05CI08	50,65	EF05CI08	28,78	EF05CI06	55,26	EF08CI10	87,50
EF05CI09	43,59	EF05CI09	11,60	EF05CI08	49,35	EF08CI11	85,72
EF06CI06	59,46	EF06CI06	19,11	EF07CI09	49,32	EF08CI08	84,13
EF06CI07	64,79	EF06CI07	17,14	EF06CI09	45,07	EF06CI07	82,86
EF06CI08	74,03	EF06CI08	34,38	EF05CI07	43,48	EF05CI06	82,60
EF06CI09	54,93	EF06CI09	22,38	EF08CI08	43,24	EF05CI07	82,36
EF06CI10	66,67	EF06CI10	20,96	EF08CI11	40,79	EF06CI06	80,88
EF07CI09	50,68	EF07CI09	27,11	EF06CI06	40,54	EF06CI10	79,04
EF07CI10	24,36	EF07CI10	8,10	EF01CI02	38,67	EF06CI09	77,62
EF08CI07	62,86	EF08CI07	36,51	EF03CI05	37,97	EF07CI09	72,89
EF08CI08	56,76	EF08CI08	15,87	EF08CI07	37,14	EF05CI08	71,22
EF08CI09	23,81	EF08CI09	5,71	EF06CI07	35,21	EF06CI08	65,62
EF08CI10	31,17	EF08CI10	12,50	EF06CI10	33,33	EF08CI07	63,49
EF08CI11	50,21	EF08CI11	14,28	EF06CI08	25,97	EF03CI05	52,72

Table 12 – Demonstrates the five first abilities cited as LOW and HIGH Confidence Pre and Post UC CHEF, Face to Face

LOW CONFIDENCE – FACE TO FACE, PRE UC CHEF		
1st	EF06CI08	VISION AND ITS DISEASES
2nd	EF06CI10	NERVOUS SYSTEM AND PSYCHOACTIVE SUBSTANCES
3rd	EF06CI07	SENSORIAL AND MOTOR PHYSIOLOGY
4th	EF08CI07	REPRODUCTION EVOLUTION
5th	EF03CI05	EMBRYOLOGY AND EVOLUTION
HIGH CONFIDENCE – FACE TO FACE, PRE UC CHEF		
1st	EF01CI03	BODY HYGIENE
2nd	EF01CI04	ANATOMICAL DIVERSITY
3rd	EF08CI09	CONTRACEPTIVE METHODS
4th	EF07CI10	VACCINATION
5th	EF08CI10	SEXUALLY TRANSMITTED INFECTIONS
LOW CONFIDENCE – FACE TO FACE, POST UC CHEF		
1st	EF03CI05	EMBRYOLOGY AND EVOLUTION
2nd	EF08CI07	REPRODUCTION EVOLUTION
3rd	EF06CI08	VISION AND ITS DISEASES
4th	EF05CI08	NUTRITION AND HEALTH
5th	EF07CI09	PUBLIC HEALTH POLICY INDICATORS
HIGH CONFIDENCE – FACE TO FACE, POS UC CHEF		
1st	EF01CI03	BODY HYGIENE
2nd	EF01CI04	ANATOMICAL DIVERSITY
3rd	EF08CI09	CONTRACEPTIVE METHODS
4th	EF07CI10	VACCINATION
5th	EF01CI02	GENERAL ANATOMY

Source, by the author, 2022

Table 13 presents the descending list of the abilities from high to low mastering by the students before and after the exposure to the UC content of the remote group. The interval of low mastering in the first classified ability (EF03CI05 – EMBRYOLOGY AND EVOLUTION) changed from 72.22% (before the UC) to 42.60% (post UC). After exposure to the UC, the interval of high mastering in the first classified ability (EF01CI04 – ANATOMICAL DIVERSITY) changed from 81.48% to 96.29%.

Table 13 – Mastering Remote, Low and High, Pre and Post UC

LOW MASTERING - REMOTE				HIGH MASTERING - REMOTE			
PRE	%	POST	%	PRE	%	POST	%
EF03CI05	72,22	EF03CI05	42,60	EF01CI04	81,48	EF01CI03	98,15
EF05CI08	68,52	EF08CI07	40,73	EF01CI03	75,92	EF01CI04	96,29
EF06CI07	66,68	EF05CI08	37,04	EF07CI10	70,38	EF07CI10	94,45
EF05CI07	66,67	EF05CI09	27,78	EF08CI09	68,52	EF08CI09	92,60
EF06CI08	66,67	EF06CI10	27,77	EF08CI10	64,81	EF08CI08	90,75
EF06CI10	64,81	EF06CI08	24,07	EF07CI09	61,11	EF06CI09	88,90
EF01CI02	62,96	EF07CI09	20,36	EF08CI07	48,45	EF06CI07	88,88
EF05CI06	61,11	EF01CI02	18,52	EF06CI09	44,45	EF05CI06	85,18
EF08CI08	59,26	EF05CI07	18,52	EF05CI09	44,44	EF08CI10	83,34
EF05CI09	55,56	EF08CI11	18,52	EF06CI06	44,44	EF06CI06	83,33
EF06CI06	55,56	EF06CI06	16,67	EF08CI11	44,44	EF01CI02	81,48
EF08CI11	55,56	EF08CI10	16,66	EF08CI08	40,74	EF05CI07	81,48
EF06CI09	55,55	EF05CI06	14,82	EF05CI06	38,89	EF08CI11	81,48
EF08CI07	51,85	EF06CI07	11,12	EF01CI02	37,04	EF07CI09	79,64
EF07CI09	38,89	EF06CI09	11,10	EF06CI10	35,19	EF06CI08	75,93
EF08CI10	35,19	EF08CI08	9,25	EF05CI07	33,33	EF06CI10	72,23
EF08CI09	31,48	EF08CI09	7,40	EF06CI08	33,33	EF05CI09	72,22
EF07CI10	29,62	EF07CI10	5,55	EF06CI07	33,32	EF05CI08	62,96
EF01CI03	24,08	EF01CI04	3,71	EF05CI08	31,48	EF08CI07	59,27
EF01CI04	18,52	EF01CI03	1,85	EF03CI05	27,78	EF03CI05	57,40

Table 15 presents the descending list of the abilities stated by the respondents as learned during primary and secondary education on the remote group before and after the UC. Generally, students stated that they learned the ability first classified in a range from 70.38% to 62.96% as the same (EF08CI09 – CONTRACEPTIVE MÉTHODS), answered YES. Coincidentally, the ability EF08CI11 – HUMAN SEXUALITY was cited as the first one before (20.87%) and after (12.96%) the UC.

Table 14 – Demonstrates the five first abilities cited as Low and High Mastering Pre and Post UC CHEF, referring to the remote group

LOW MASTERING – REMOTE – PRE UC CHEF		
1st	EF03CI05	EMBRYOLOGY AND EVOLUTION
2nd	EF05CI08	NUTRITION AND HEALTH
3rd	EF06CI07	SENSORIAL AND MOTOR PHYSIOLOGY
4th	EF05CI07	CARDIOVASCULAR SYSTEM
5th	EF06CI08	VISION AND ITS DISEASES
HIGH MASTERING – REMOTE – PRE UC CHEF		
1st	EF01CI04	ANATOMICAL DIVERSITY
2nd	EF01CI03	BODY HYGIENE
3rd	EF07CI10	VACCINATION
4th	EF08CI09	CONTRACEPTIVE METHODS
5th	EF08CI10	SEXUALY TRANSMITTED INFECCIONS
LOW MASTERING – REMOTE – POST UC CHEF		
1st	EF03CI05	EMBRYOLOGY AND EVOLUTION
2nd	EF08CI07	REPRODUCTION EVOLUÇÃO
3rd	EF05CI08	NUTRITION AND HEALTH
4th	EF05CI09	NUTRITIONAL DISORDERS
5th	EF06CI10	NERVOUS SYSTEM AND PSYCHOATIVE SUBSTANCES
HIGH MASTERING – REMOTE – POST UC CHEF		
1st	EF01CI03	BODY HYGIENE
2nd	EF01CI04	ANATOMICAL DIVERSITY
3rd	EF07CI10	VACCINATION
4th	EF08CI09	CONTRACEPTIVE METHODS
5th	EF08CI08	PUBERTY TRANSFORMATIONS

Source, by the author, 2022.

Table 15 – Learning REMOTE, Yes or No, Pre and Post UC

LEARNING REMOTE			
PRE - YES	%	POST - YES	%
EF08CI09	70,38	EF08CI09	62,96
EF01CI03	68,52	EF08CI07	61,11
EF08CI07	66,66	EF08CI10	61,11
EF07CI10	64,82	EF01CI03	59,26
EF08CI10	62,96	EF07CI10	53,70
EF03CI05	59,26	EF03CI05	46,29
EF08CI08	59,26	EF08CI08	44,45
EF01CI02	57,40	EF05CI09	40,74
EF06CI09	57,40	EF01CI04	38,89
EF07CI09	57,40	EF05CI06	38,89
EF05CI06	53,70	EF01CI02	38,88
EF05CI07	51,86	EF07CI09	35,18
EF06CI06	50,00	EF06CI07	29,63
EF06CI07	50,00	EF06CI08	29,63
EF05CI09	48,15	EF05CI07	27,78
EF06CI08	44,44	EF05CI08	25,92
EF05CI08	37,03	EF06CI09	25,92
EF06CI10	37,02	EF06CI06	22,22
EF01CI04	35,19	EF06CI10	12,96
EF08CI11	20,87	EF08CI11	12,96

Table 16 – Demonstrates the five first abilities cited as YES and NO – Learning Pre and Post UC CHEF, Remote

LEARNING REMOTE, YES, PRE UC CHEF		
1 st	EF08CI09	CONTRACEPTIVE METHODS
2 nd	EF01CI03	BODY HYGIENE
3 rd	EF08CI07	REPRODUCTION EVOLUTION
4 th	EF07CI10	VACCINATION
5 th	EF08CI10	SEXUALY TRANSMITTED INFECTIONS
LEARNING REMOTE, NO, PRE UC CHEF		
1 st	EF08CI11	HUMAN SEXUALITY
2 nd	EF06CI10	NERVOUS SYSTEM AND PSYCHOACTIVE SUBSTANCES
3 rd	EF01CI04	ANATOMICAL DIVERSITY
4 th	EF05CI08	NUTRITION AND HEALTH
5 th	EF05CI09	NUTRICIONAL DISORDERS
LEARNING REMOTE, YES, POST UC CHEF		
1 st	EF08CI09	CONTRACEPTIVE METHODS
2 nd	EF08CI07	REPRODUCTION EVOLUTION
3 rd	EF08CI10	SEXUALY TRANSMITTED INFECTIONS
4 th	EF01CI03	BODY HYGIENE
5 th	EF07CI10	VACCINATION
LEARNING REMOTE, NO, POST UC CHEF		
1 st	EF08CI11	HUMAN SEXUALITY
2 nd	EF06CI10	NERVOUS SYSTEM AND PSYCHOACTIVE SUBSTANCES
3 rd	EF01CI04	ANATOMICAL DIVERSITY
4 th	EF05CI08	NUTRITION AND HEALTH
5 th	EF05CI09	NUTRICIONAL DISORDERS

Source, by the author, 2022.

Table 17 presents the descending list with low and high confidence of teaching the abilities by the students according to the remote group. Before exposure to the course content, the interval of low confidence to teach the first ability classified (EF06CI07 – SENSORIAL AND MOTOR PHYSIOLOGY) changed from 34.09% to 94.45%, showing a very important improvement in their confidence to teach. After exposure to the UC content, in the same group, the interval of high confidence in the first ability classified (EF01CI03 – BODY HYGIENE) changed from 93.33% to 100%, also promoting an important change.

Table 17 – Confidence Remote, Low and High, Pre and Post UC, in descending classification

CONFIDENCE - REMOTE			
PRE - HIGH	%	POST - HIGH	%
EF01CI03	93,33	EF01CI03	100,00
EF01CI04	91,30	EF07CI10	100,00
EF07CI10	87,24	EF08CI09	96,30
EF08CI09	77,55	EF01CI04	94,45
EF08CI10	75,56	EF06CI07	94,45
EF07CI09	68,89	EF01CI02	92,60
EF05CI09	60,47	EF05CI06	92,60
EF06CI09	60,47	EF05CI07	90,74
EF08CI07	55,82	EF06CI09	90,74
EF08CI11	47,62	EF07CI09	90,74
EF05CI08	46,51	EF08CI10	90,74
EF08CI08	45,45	EF08CI11	88,89
EF05CI06	44,90	EF05CI09	87,04
EF06CI10	44,45	EF08CI08	87,04
EF03CI05	39,58	EF06CI06	85,18
EF06CI08	39,54	EF06CI08	83,33
EF06CI06	39,13	EF06CI10	81,48
EF01CI02	38,64	EF05CI08	75,93
EF05CI07	36,84	EF08CI07	75,92
EF06CI07	34,09	EF03CI05	74,08

Table 18 – Demonstrates the five first abilities cited as LOW and HIGH Confidence Pre and Post UC CHEF, remote

LOW CONFIDENCE – REMOTE, PRE UC CHEF		
1st	EF06CI07	SENSORIAL AND MOTOR PHYSIOLOGY
2nd	EF05CI07	CARDIOVASCULAR SYSTEM
3rd	EF01CI02	GENERAL ANATOMY
4th	EF06CI06	SYSTEMS ORGANIZATION
5th	EF06CI08	VISION AND ITS DISEASES
HIGH CONFIDENCE – REMOTE, PRE UC CHEF		
1st	EF01CI03	BODY HYGIENE
2nd	EF01CI04	ANATOMICAL DIVERSITY
3rd	EF07CI10	VACCINATION
4th	EF08CI09	CONTRACEPTIVE METHODS
5th	EF08CI10	SEXUALY TRANSMITTED INFECTIONS
LOW CONFIDENCE – REMOTE, POST UC CHEF		
1st	EF03CI05	EMBRYOLOGY AND EVOLUTION
2nd	EF08CI07	REPRODUCTION EVOLUTION
3rd	EF05CI08	NUTRITION AND HEALTH
4th	EF06CI10	NERVOUS SYSTEM AND PSYCHOACTIVE SUBSTANCES
5th	EF06CI08	VISION AND ITS DISEASES
HIGH CONFIDENCE – REMOTE, POS UC CHEF		
1st	EF01CI03	BODY HYGIENE
2nd	EF07CI10	VACCINATION
3rd	EF08CI09	CONTRACEPTIVE METHODS
4th	EF01CI04	ANATOMICAL DIVERSITY
5th	EF06CI07	SENSORIAL AND MOTOR PHYSIOLOGY

Source, by the author, 2022

5.3 Comparative analysis

Table 19 and pictures presents the abilities classified as the highest first five mentioned by the respondents in both pre and post questionnaires, face to face and remote, related to the UC CHEF in mastering, learning and confidence in teaching, before and after the discipline, related to the human body and its physiology.

Table 20 and pictures presents the abilities classified as the lowest first five mentioned by the respondents in both pre and post questionnaires, face to face and remote, related to the UC CHEF in mastering, learning and confidence in teaching, before and after the discipline, related to the human body and its physiology.

Table 19 – Mastering, Learning and Confidence Face to Face x Remote, highest best abilities classified

HIGH MASTERING											
		1st		2nd		3rd		4th		5th	
		Activity Code	Name	Activity Code	Name	Ability Code	Name	Ability Code	Name	Ability Code	Name
Face to Face	Pre	EF01CI04	Anatomical diversity	EF01CI03	Body hygiene	EF08CI09	Contraceptive methods	EF07CI10	Vaccination	EF08CI10	Sexually transmitted infections
	Post	EF01CI04	Anatomical diversity	EF01CI03	Body hygiene	EF07CI10	Vaccination	EF01CI02	General Anatomy	EF08CI09	Contraceptive methods
Remote	Pre	EF01CI04	Anatomical diversity	EF01CI03	Body hygiene	EF07CI10	Vaccination	EF08CI09	Contraceptive methods	EF08CI10	Sexually transmitted infections
	Post	EF01CI03	Body hygiene	EF01CI04	Anatomical diversity	EF07CI10	Vaccination	EF08CI09	Contraceptive methods	EF08CI08	Puberty transformations
LEARNING YES											
		1st		2nd		3rd		4th		5th	
		Ability Code	Name	Ability Code	Name	Ability Code	Name	Ability Code	Name	Ability Code	Name
Face to Face	Pre	EF01CI03	Body hygiene	EF08CI08	Puberty transformations	EF08CI09	Contraceptive methods	EF08CI10	Sexually transmitted infections	EF05CI08	Nutrition and Health
	Post	EF01CI02	General Anatomy	EF01CI03	Body hygiene	EF01CI04	Anatomical diversity	EF03CI05	Embryology and Evolution	EF05CI06	Digestive and respiratory system
Remote	Pre	EF08CI09	Contraceptive methods	EF01CI03	Body hygiene	EF08CI07	Reproduction Evolution	EF07CI10	Vaccination	EF08CI10	Sexually transmitted infections
	Post	EF08CI09	Contraceptive methods	EF08CI07	Reproduction Evolution	EF08CI10	Sexually transmitted infections	EF01CI03	Body hygiene	EF07CI10	Vaccination
HIGH CONFIDENCE											
		1st		2nd		3rd		4th		5th	
		Ability Code	Name	Ability Code	Name	Ability Code	Name	Ability Code	Name	Ability Code	Name
Face to Face	Pre	EF01CI03	Body hygiene	EF01CI04	Anatomical diversity	EF08CI09	Contraceptive methods	EF07CI10	Vaccination	EF08CI10	Sexually transmitted infections
	Post	EF01CI03	Body hygiene	EF01CI04	Anatomical diversity	EF08CI09	Contraceptive methods	EF07CI10	Vaccination	EF01CI02	General Anatomy
Remote	Pre	EF01CI03	Body hygiene	EF01CI04	Anatomical diversity	EF07CI10	Vaccination	EF08CI09	Contraceptive methods	EF08CI10	Sexually transmitted infections
	Post	EF01CI03	Body hygiene	EF07CI10	Vaccination	EF08CI09	Contraceptive methods	EF01CI04	Anatomical diversity	EF06CI07	Sensorial and Motor Physiology

Source, by the author, 2022

Table 20 – Mastering, Learning and Confidence Face to Face x Remote, lowest best abilities classified

LOW MASTERING											
		1st		2nd		3rd		4th		5th	
		Activity Code	Name	Activity Code	Name	Ability Code	Name	Ability Code	Name	Ability Code	Name
Face to Face	Pre	EF06CI08	Vision and its Diseases	EF06CI07	Sensorial and Motor Physiology	EF05CI07	Cardiovascular System	EF08CI07	Reproduction Evolution	EF03CI05	Embryology and Evolution
	Post	EF03CI05	Embryology and Evolution	EF08CI07	Reproduction Evolution	EF07CI09	Public Policy Indicators for Health	EF05CI08	Nutrition and Health	EF06CI08	Vision and its Diseases
Remote	Pre	EF03CI05	Embryology and Evolution	EF05CI08	Nutrition and Health	EF06CI07	Sensorial and Motor Physiology	EF05CI07	Cardiovascular System	EF06CI08	Vision and its Diseases
	Post	EF03CI05	Embryology and Evolution	EF08CI07	Reproduction Evolution	EF05CI08	Nutrition and Health	EF05CI09	Nutritional Disorders	EF06CI10	Nervous System and Psychoactive Substances
LEARNING NO											
		1st		2nd		3rd		4th		5th	
		Activity Code	Name	Ability Code	Name	Ability Code	Name	Ability Code	Name	Ability Code	Name
Face to Face	Pre	EF08CI11	Human sexuality	EF06CI10	Nervous System and Psychoactive Substances	EF05CI09	Nutritional Disorders	EF07CI09	Public Policy Indicators for Health	EF06CI08	Vision and its Diseases
	Post	EF06CI10	Nervous System and Psychoactive Substances	EF06CI07	Sensorial and Motor Physiology	EF07CI09	Public Policy Indicators for Health	EF06CI09	Structure and control of locomotion	EF05CI09	Nutritional Disorders
Remote	Pre	EF08CI11	Human sexuality	EF06CI10	Nervous System and Psychoactive Substances	EF01CI04	Anatomical diversity	EF05CI08	Nutrition and Health	EF05CI09	Nutritional Disorders
	Post	EF08CI11	Human sexuality	EF06CI10	Nervous System and Psychoactive Substances	EF01CI04	Anatomical diversity	EF05CI08	Nutrition and Health	EF05CI09	Nutritional Disorders
LOW CONFIDENCE											
		1st		2nd		3rd		4th		5th	
		Activity Code	Name	Ability Code	Name	Ability Code	Name	Ability Code	Name	Ability Code	Name
Face to Face	Pre	EF06CI08	Vision and its Diseases	EF06CI07	Sensorial and Motor Physiology	EF08CI07	Reproduction Evolution	EF03CI05	Embryology and Evolution	EF01CI02	General Anatomy
	Post	EF03CI05	Embryology and Evolution	EF08CI07	Reproduction Evolution	EF06CI08	Vision and its Diseases	EF05CI08	Nutrition and Health	EF07CI09	Public Policy Indicators for Health
Remote	Pre	EF03CI05	Embryology and Evolution	EF05CI08	Nutrition and Health	EF06CI07	Sensorial and Motor Physiology	EF05CI07	Cardiovascular System	EF06CI08	Vision and its Diseases
	Post	EF03CI05	Embryology and Evolution	EF08CI07	Reproduction Evolution	EF05CI08	Nutrition and Health	EF05CI09	Nutritional Disorders	EF06CI10	Nervous System and Psychoactive Substances

Source, by the author, 2022

As shown in the previous tables, when answering the face to face before and after the UC CHEF, the respondents stated that concerning to the abilities mastered during their formation, EF01CI04 Anatomic Diversity and EF01CI03 Body Hygiene were cited as the first and the second classified in both groups, face-to-face and remote. When we consider the third classified, the respondents pointed in the face-to-face questionnaire the ability EF08CI09 Contraceptive Methods before the UC and EF07CI10 Vaccination after the UC, which was also the ability cited as the third classified before and after the UC in the remote questionnaire.

However, the ability EF07CI10 – VACCINATION was pointed as the fourth in the face-to-face group as the fourth pre-classified and EF01CI02 – GENERAL ANATOMY post. The ability cited as the third pre UC EF08CI09 – CONTRACEPTIVE METHODS was classified as the fifth one after the respondents pass through the UC, who also declared EF08CI10 Sexually transmitted Infections (nominated in BNCC as DST – Sexually transmitted Diseases) as the fifth one before the UC. The last one after the UC for this group was the ability EF08CI09 – CONTRACEPTIVE METHODS.

Very similar results regarding mastering appeared in the questionnaires applied remotely due to the COVID-19 pandemic as it can be seen. The ability EF01CI04 – ANATOMIC DIVERSITY was cited as the first one before and the second after the UC. EF01CI03 – BODY HYGIENE was classified as the second and the first one in groups post and pre UC, respectively. Coincidentally EF07CI10 – VACCINATION which was indicated as the third one in the face-to-face group, also appears as the third in the remote group before and after the UC. As the fourth, pre and post the UC, the EF08CI09 – CONTRACEPTIVE METHODS was cited as fourth classified pre and post in the remote group. The fifth one cited as pre UC is EF08CI10 – SEXUALLY TRANSMITTED INFECTIONS and the ability EF08CI09 – PUBERTY TRANSFORMATIONS after the UC.

The YES and NO answers were considered in this r–search as a way of having a view of whether the respondents learned the abilities about the human body listed in the BNCC during elementary or high school. “I don’t remember” answers were not considered. In both questionnaires the answers were very similar.

As we can observe, when answering YES in the face to face questionnaire, the respondents classified the abilities EF01CI03 Body Hygiene as the first before and the second after the UC CHEF. After the UC EF01CI02 General Anatomy was cited as the first learned. Before the UC, EF08CI08 appeared as the second and respectively, as the third, fourth and fifth, EF03CI05 Contraceptive Methods, EF08CI10 Sexually transmitted Infections and EF05CI06 Digestive and Respiratory Systems. After the UC the classification was as the third, fourth and fifth were EF01CI04 Anatomical Diversity, EF03CI05 Embryology and Evolution and EF05CI06 Digestive and Respiratory Systems. When we observe the remote questionnaire answers, EF08CI09 – Contraceptive Methods appeared as the first ones pre and post UC. EF01CI03 Body Hygiene the second in the pre and the fourth in the post. EF08CI07 Reproduction Evolution is the third in the pre and the second in the post as EF07CI10 Vaccination is the fourth pre and the fifth post. Before the UC EF08CI10 Sexually Transmitted Infections is the fifth one, whereas being the third one post UC CHEF.

The results regarding the confidence to teach the abilities in both questionnaires before and after the UC CHEF showed an interesting level of significance, making evident that the respondents showed improvements, as can be inferred from the data scored in the previous tables. The first ability cited by the respondents in both questionnaires, face to face and remote, pre and post UC was EF01CI03 Body Hygiene. EF01CI04 Anatomical Diversity appeared as the second in the Face to Face pre and post, the second and the fourth in the remote. EF07CI10 Vaccination was pointed by the students as the fourth pre and post in the Face to Face questionnaire, but as the second in the post and the third in the pre remote questionnaire respectively. Furthermore, the ability EF08CI09 Contraceptive Methods was pointed as third in pre and post remote but fourth in the pre and third in the post, respectively. Concerning to the Face to Face group, the fifth abilities cited were EF08CI10 Sexually Transmitted Infections before and EF01CI02 General Anatomy after the UC CHEF. Remotely answering the questionnaires, the students declared as the Fifth pre UC ability they were more confident in teaching if they were challenged to do EF08CI10 Sexually Transmitted Infections, and post EF06CI07 Sensorial and Motor Physiology. We can infer from these results that the students

have changed their conceptions about the abilities they thought having less dominance before the UC CHEF, being clear that they have changed their perceptions about these abilities after doing the course.

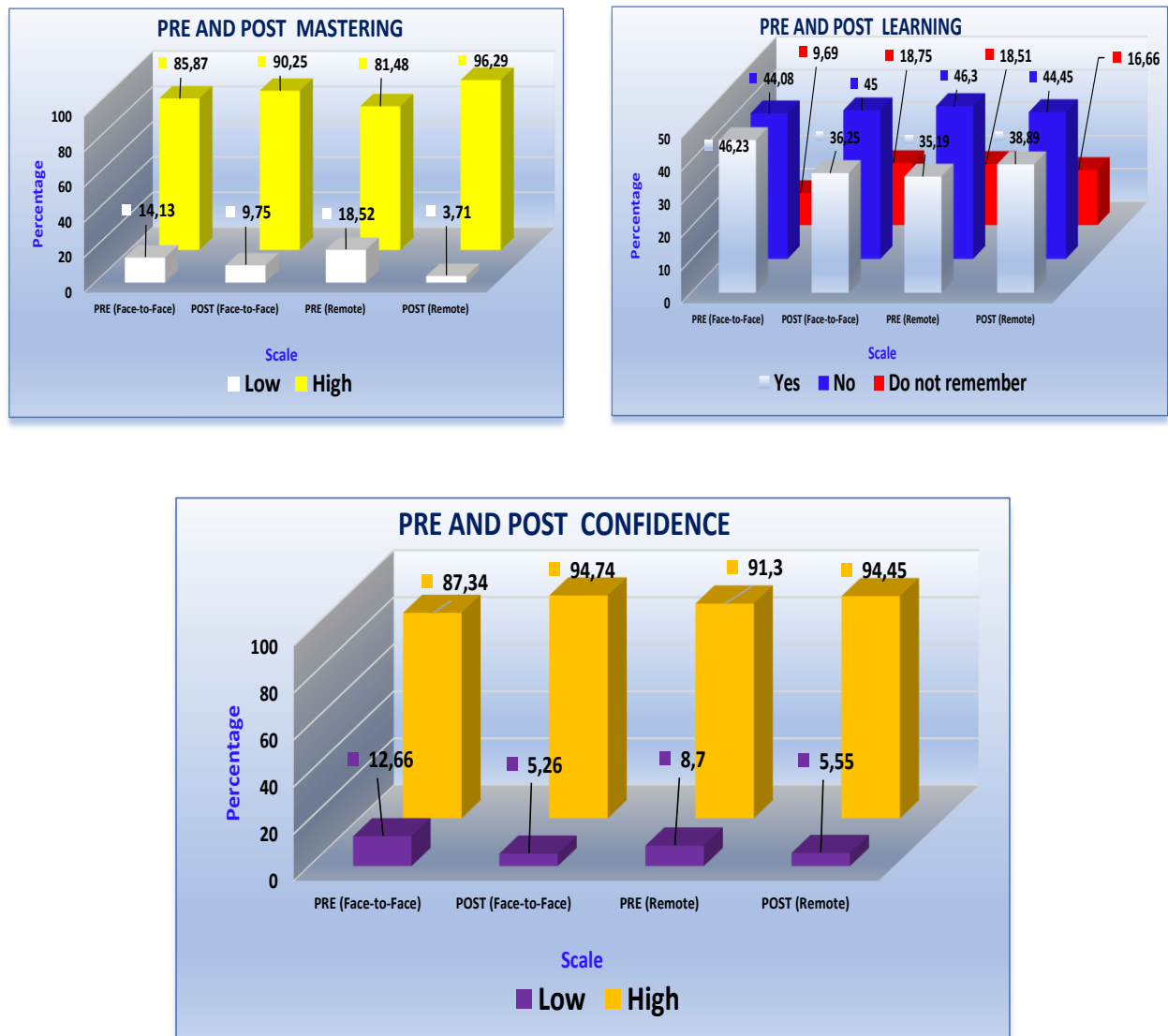
In the sequence, we demonstrate by graphs the five abilities best classified by respondents in the pre and post face-to-face and remotely answered questionnaires. However, an overall view of the twenty abilities from BNCC are shown in graphics on page 74 (Appendix 9.2: Graphs: BNCC Abilities – Human Body – Comparative Pre and Post).

The following figures compares the information referring to Mastering of the five abilities best classified by the respondents as mastered in the pre and post questionnaires, face-to-face and remote. For comparison, information about Learning and Confidence to teach concerning these abilities were included. Thus, well said, the abilities demonstrated are, in descending order, the five reported as the most mastered by the students.

Face to Face questionnaire, 1st EF01CI04 Anatomical Diversity, 2nd EF01CI03 Body Hygiene, 3rd EF08CI09 Contraceptive Methods, 4th EF07CI10 Vaccination and 5th EF08CI10 Sexually Transmitted Infections.

Remote questionnaire, 1st EF01CI04 Anatomical Diversity, 2nd EF01CI03 Body Hygiene, 3rd EF07CI10 Vaccination, 4th EF08CI09 Contraceptive Methods and 5th EF08CI10 Sexually Transmitted Infections.

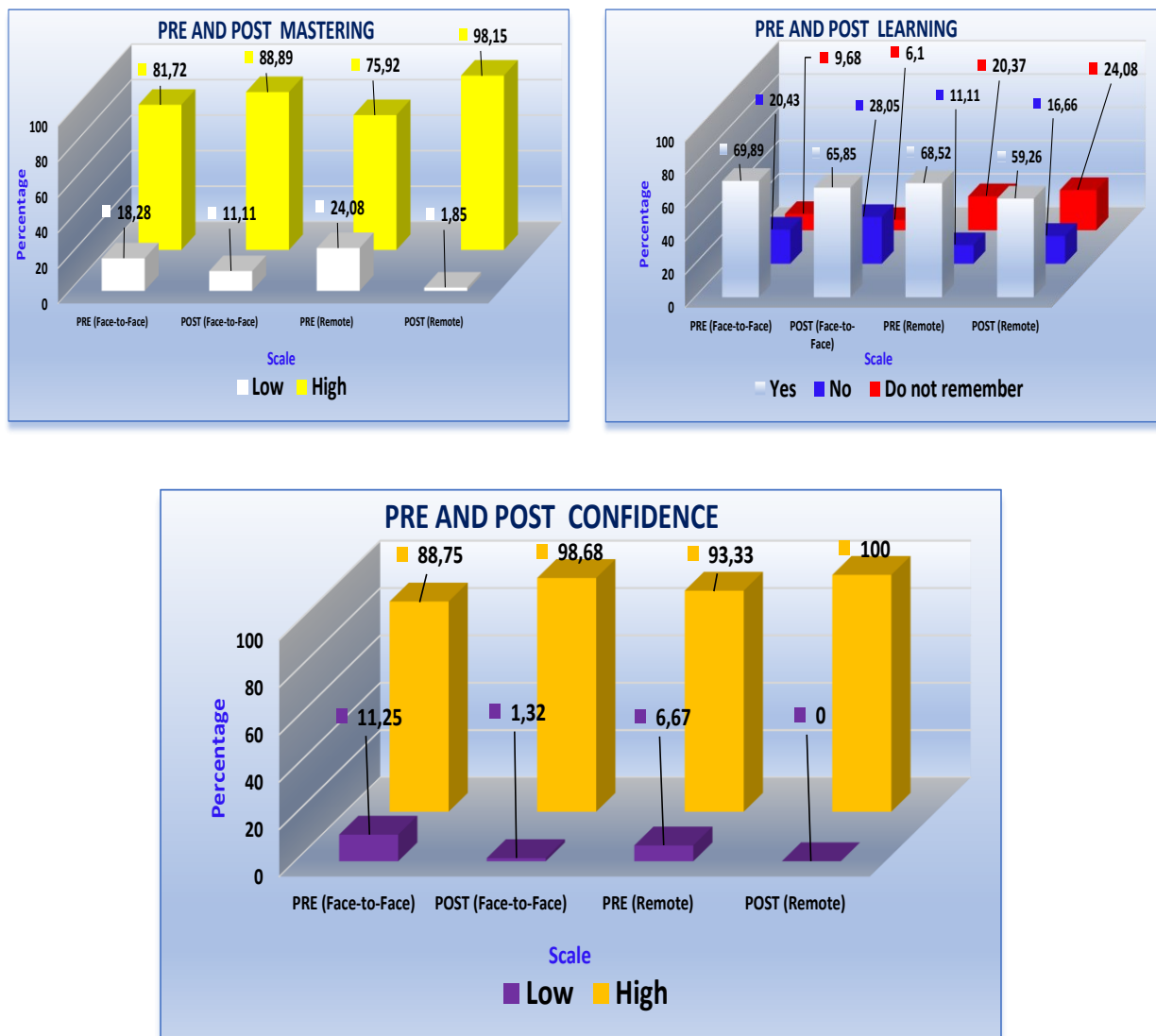
EF01CI04 - Anatomical Diversity



Source: by the author, 2022.

Figure 2 – 1st FACE TO FACE, Mastering, Learning and confidence.

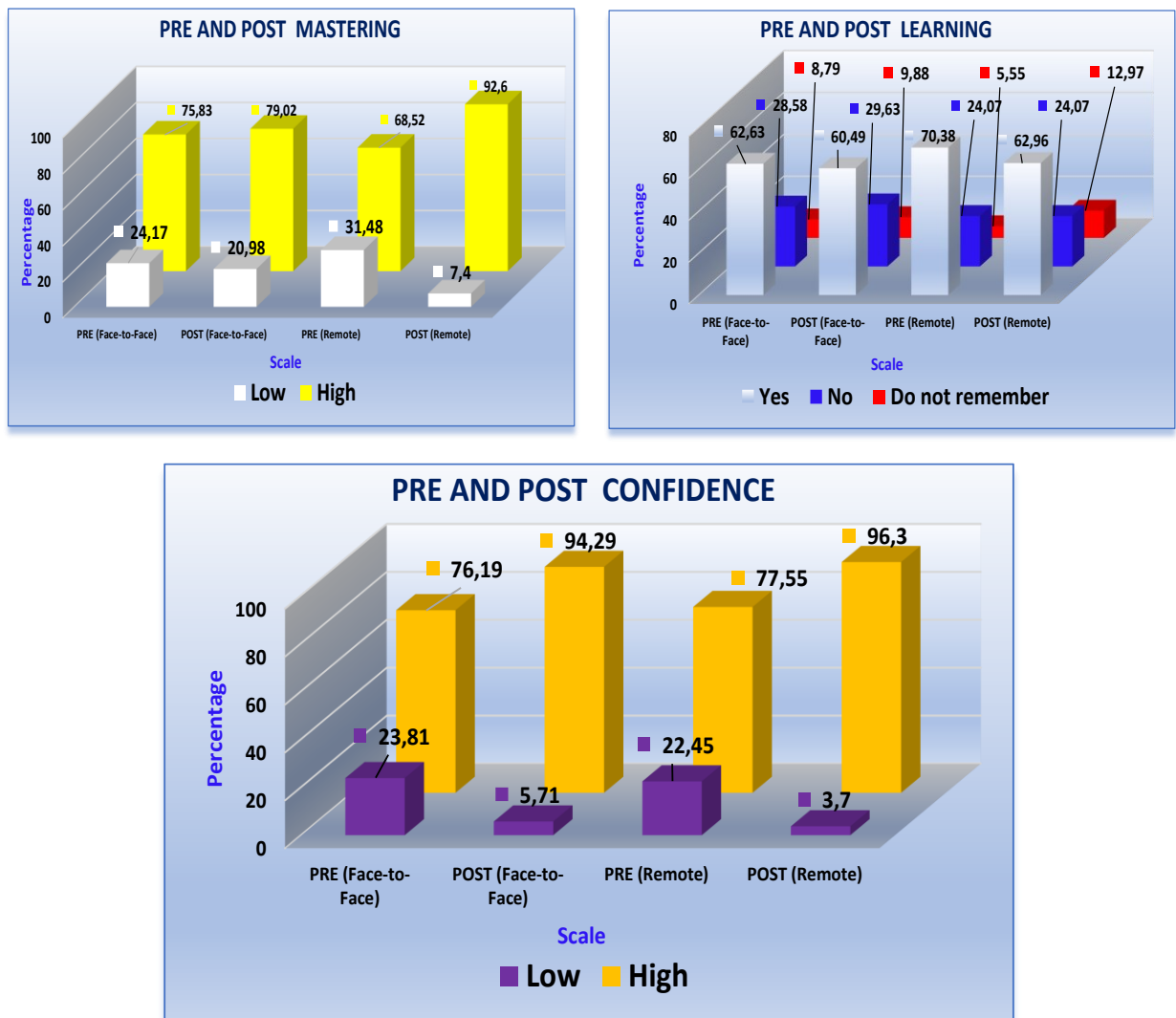
EF01CI03 – Body Higyene



Source: by the author, 2022.

Figure 3 – 2nd FACE TO FACE, Mastering, Learning and Confidence

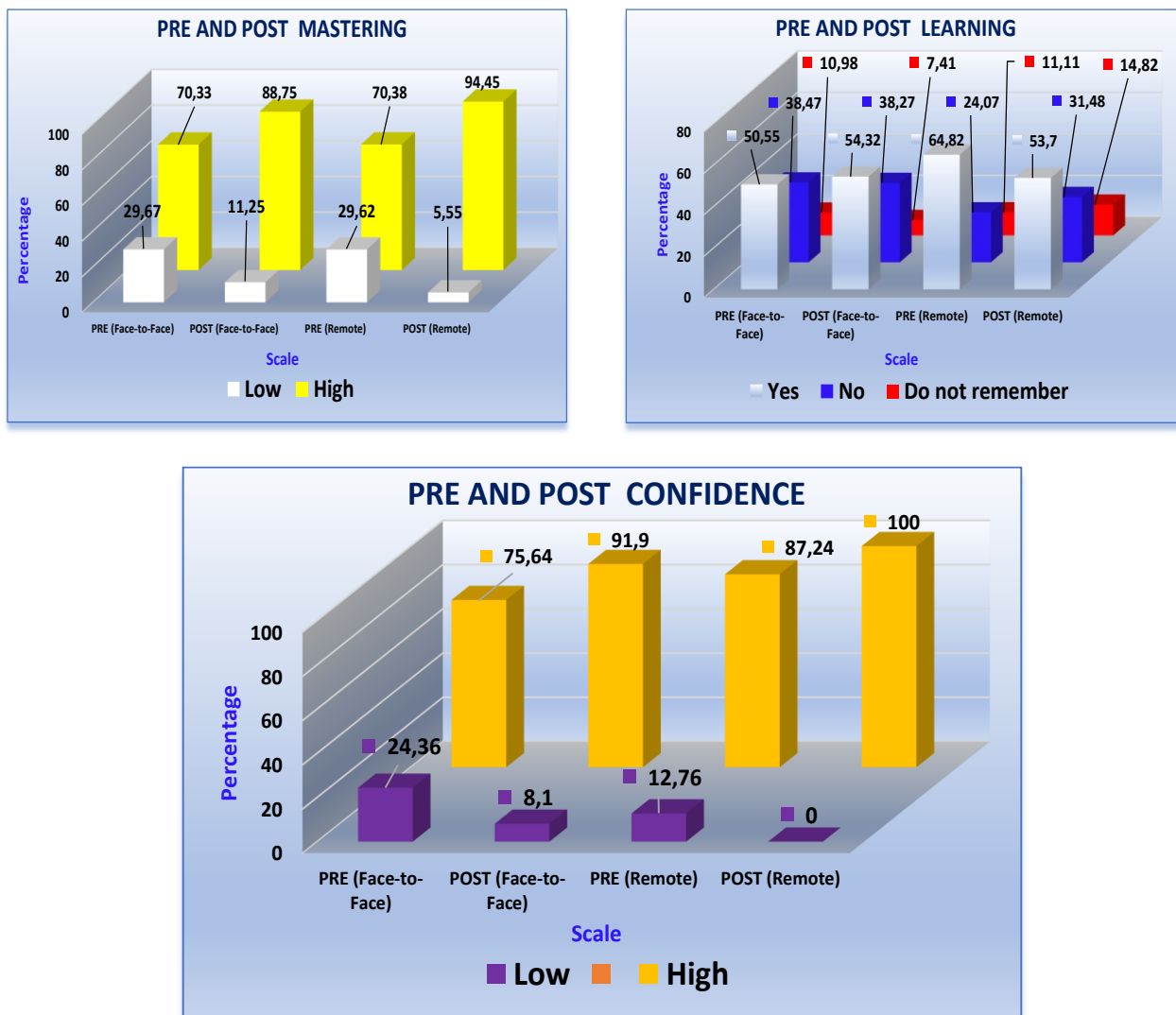
EF08CI09 - Contraceptive Methods



Source: by the author, 2022.

Figure 4 – 3rd FACE TO FACE, Mastering, Learning and Confidence.

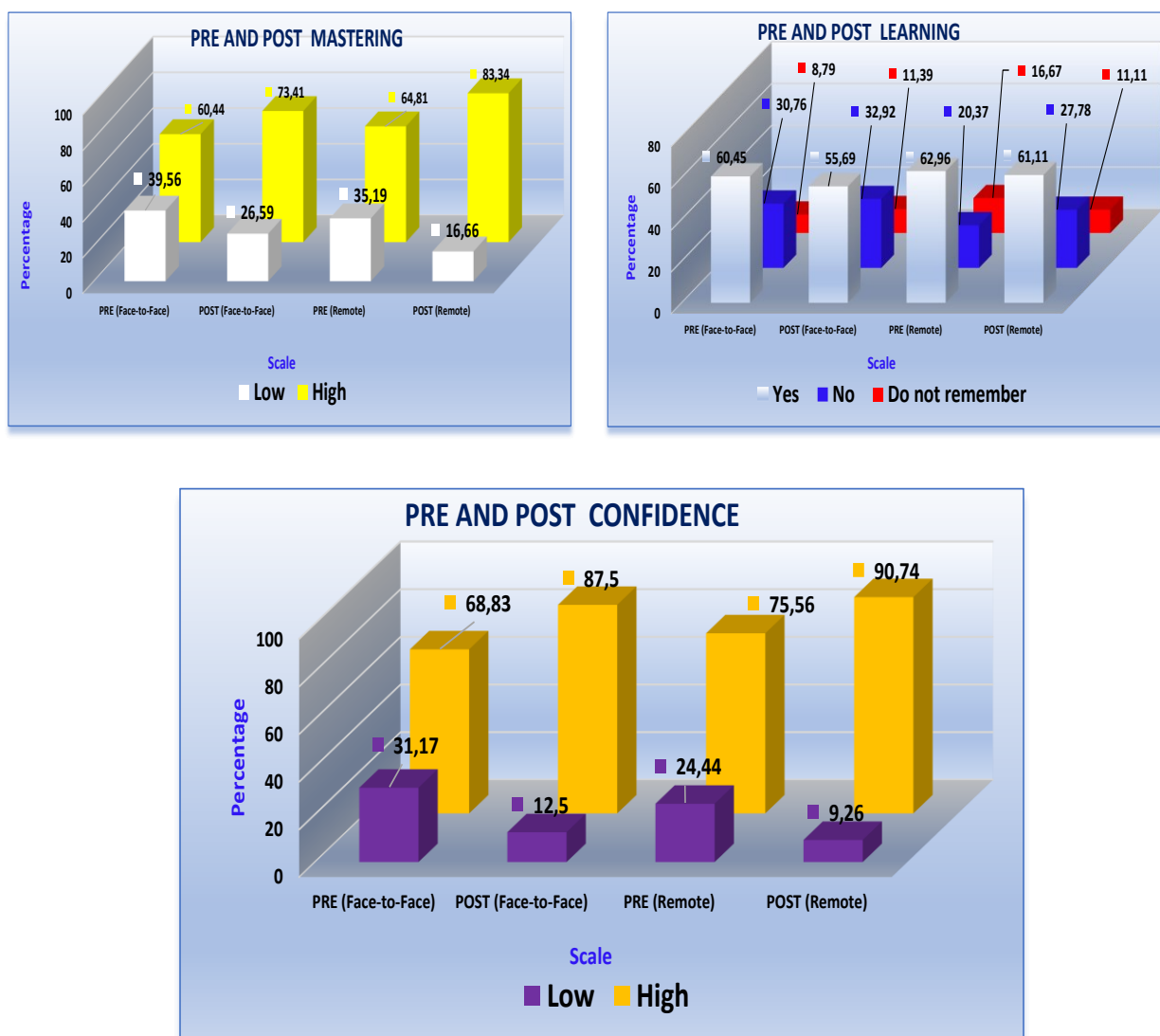
EF07CI10 – VACCINATION



Source: by the author, 2022.

Figure 5 – 4th FACE TO FACE, Mastering, Learning and Confidence.

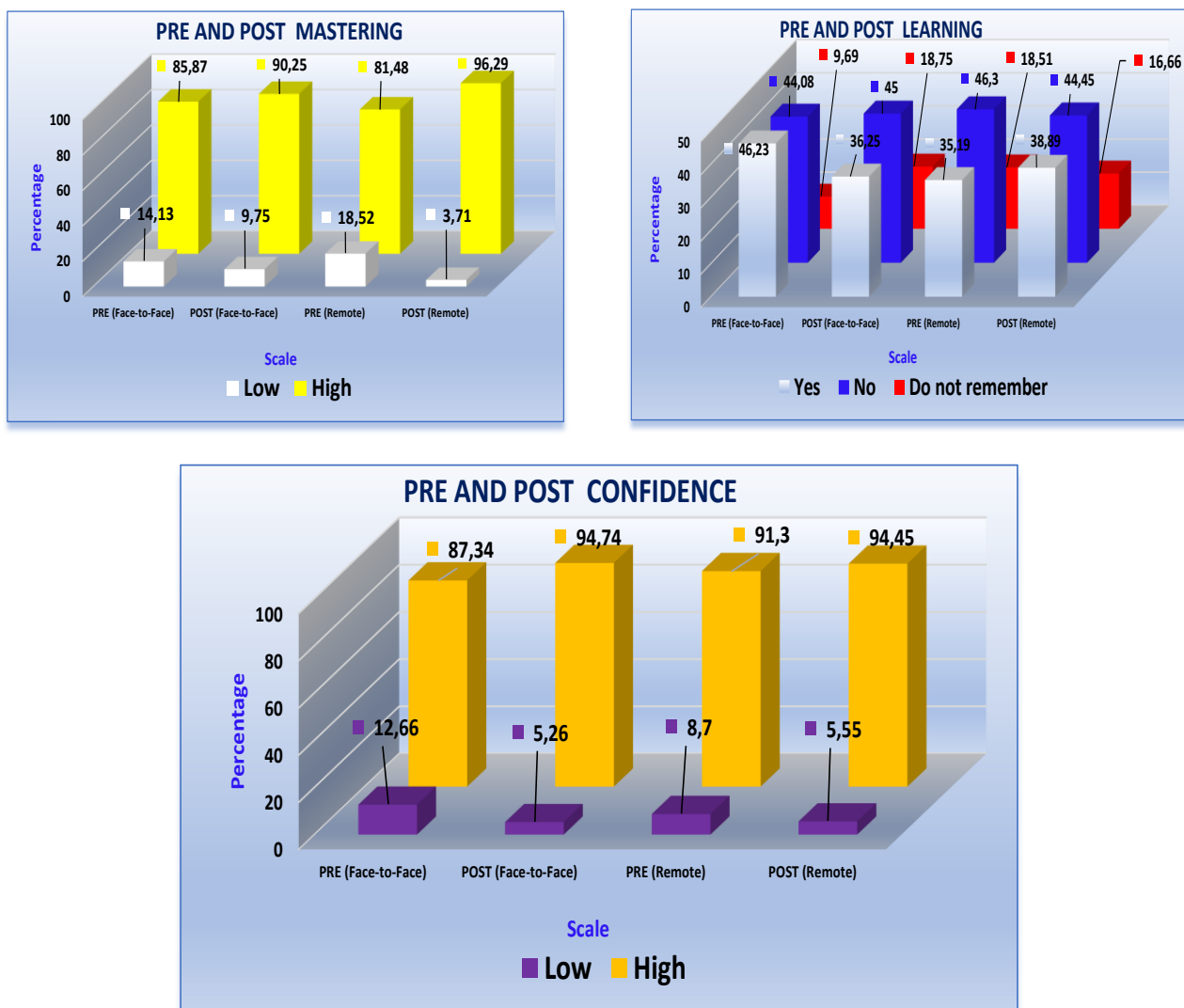
EF08CI10 – Sexually Transmitted Diseases



Source: by the author, 2022.

Figure 6 – 5th FACE TO FACE, Mastering, Learning and Confidence.

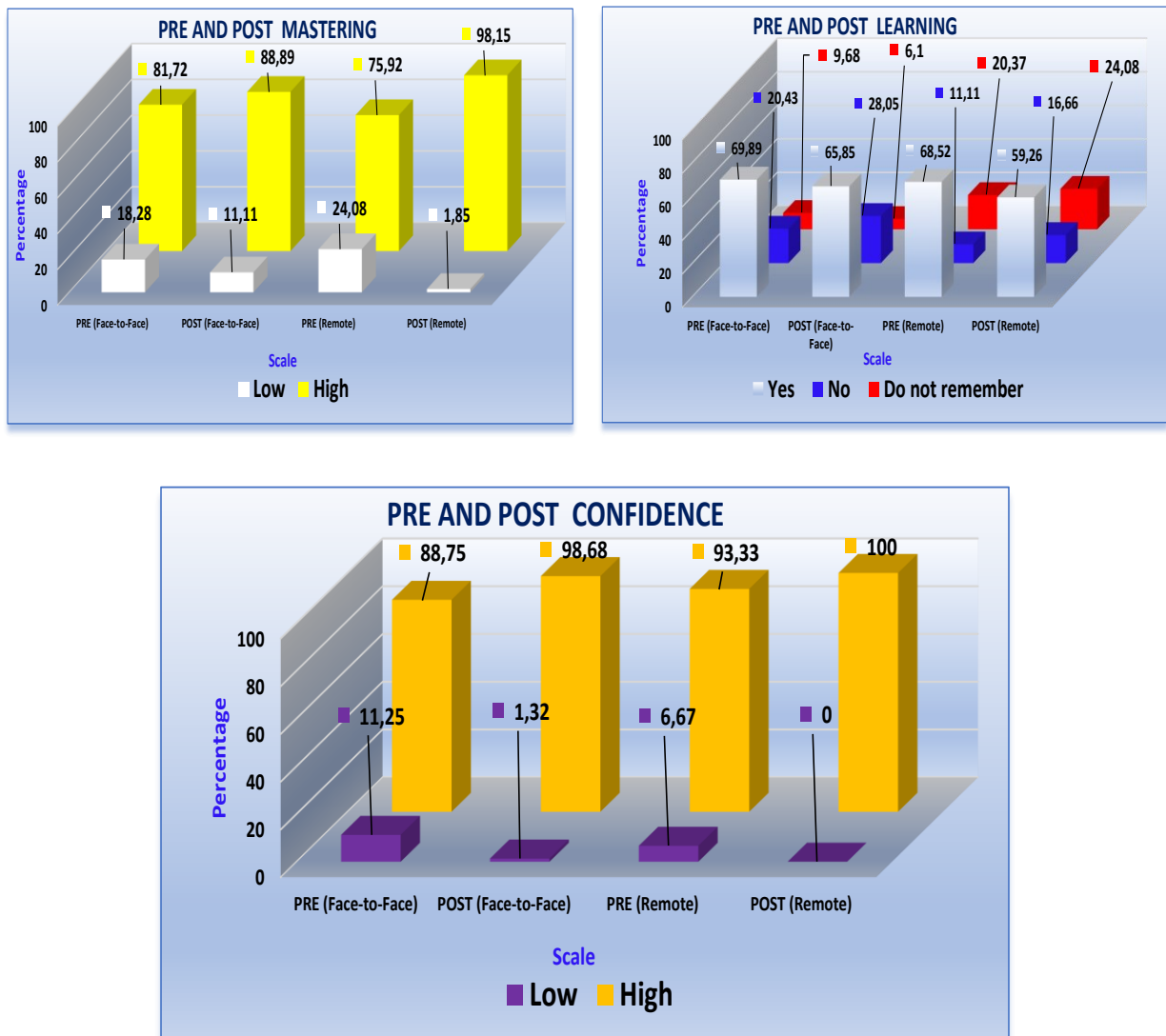
EF01CI04 – Anatomical Diversity



Source: by the author, 2022.

Figure 7 – 1st REMOTE, Mastering, Learning and Confidence

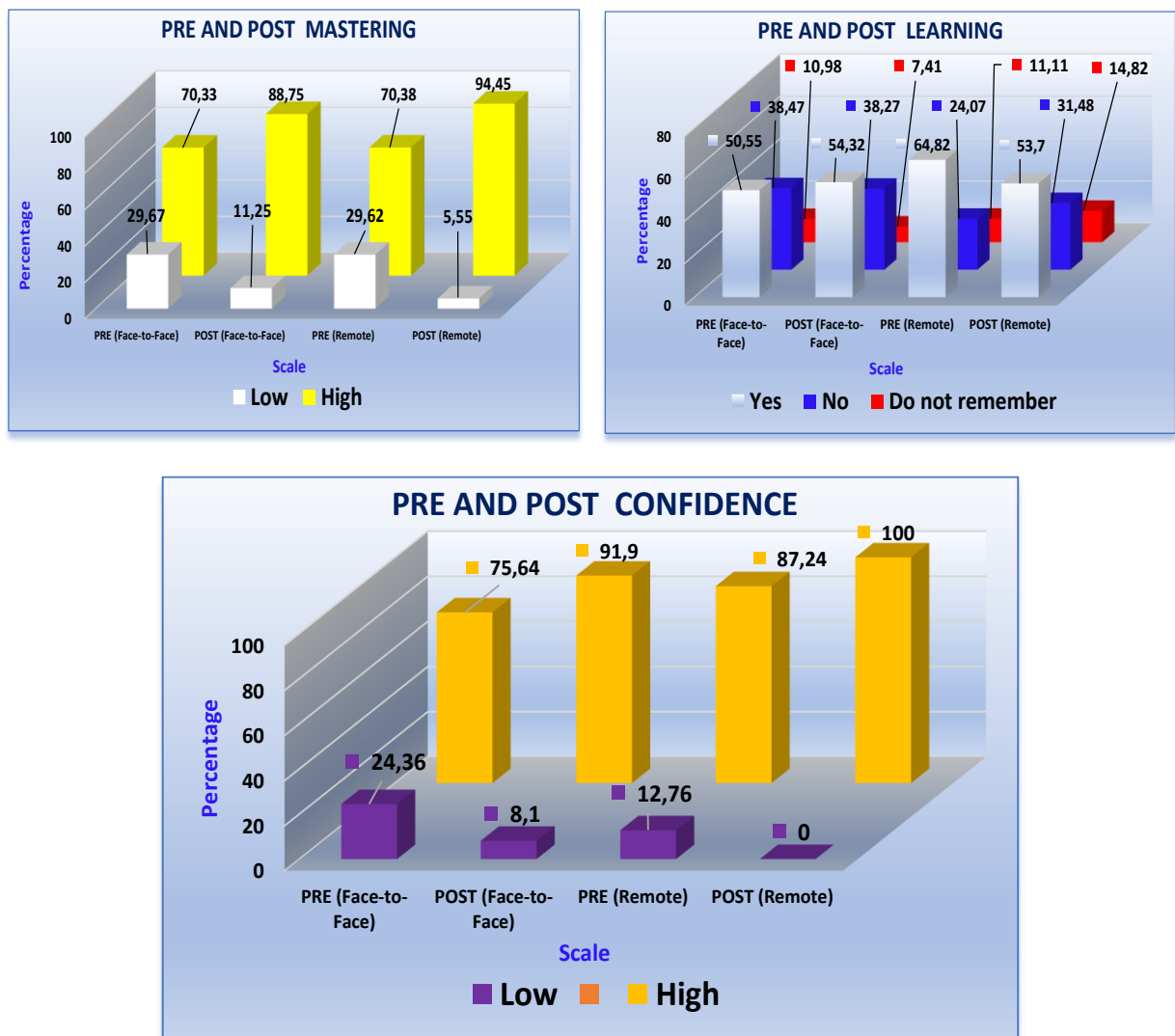
EF01CI03 – Body Hygiene



Source: by the author, 2022.

Figure 8 – 2nd REMOTE, Mastering, Learning and Confidence

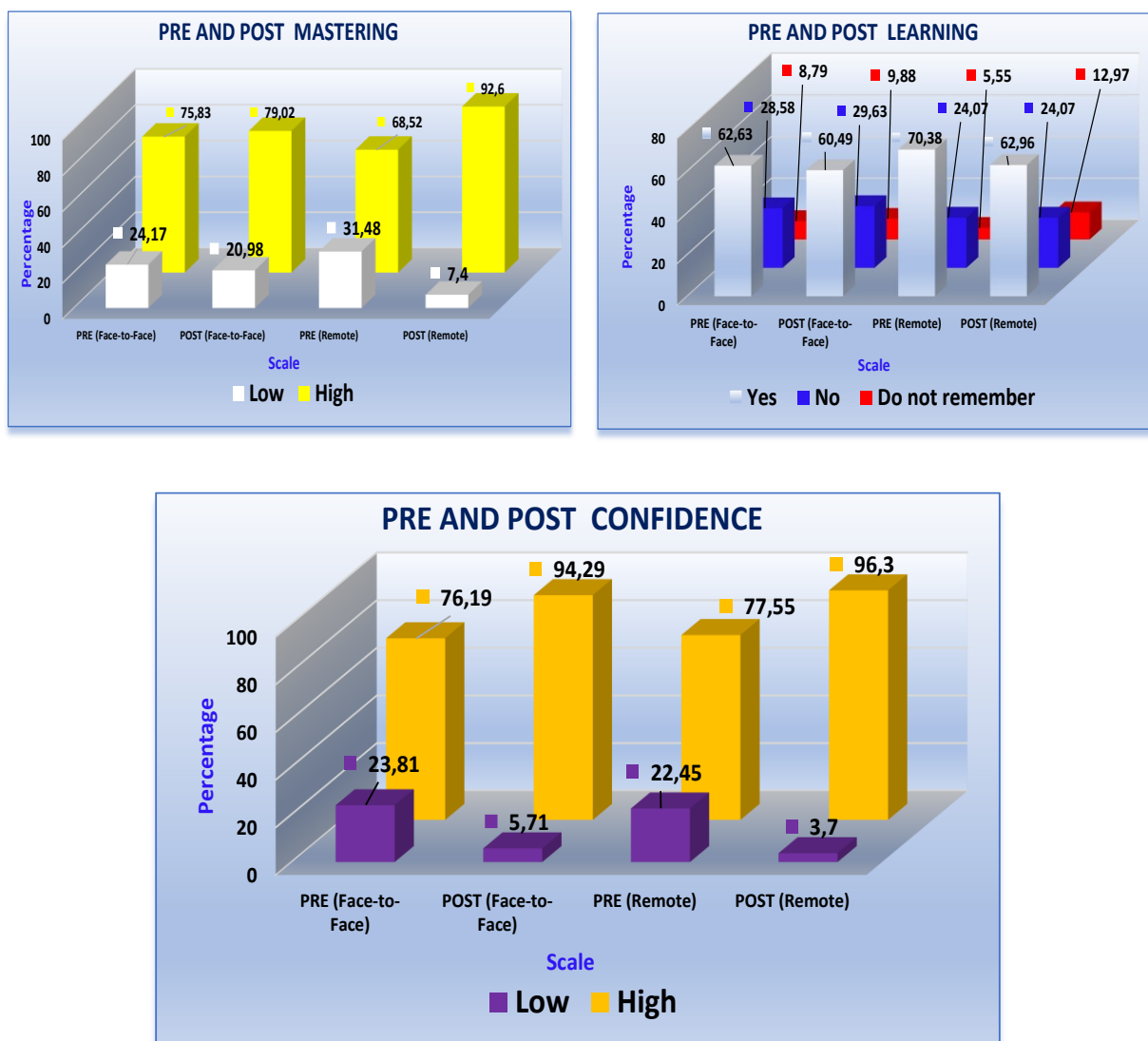
EF07CI10 – Vaccination



Source: by the author, 2022.

Figure 9 – 3rd REMOTE, Mastering, Learning and Confidence

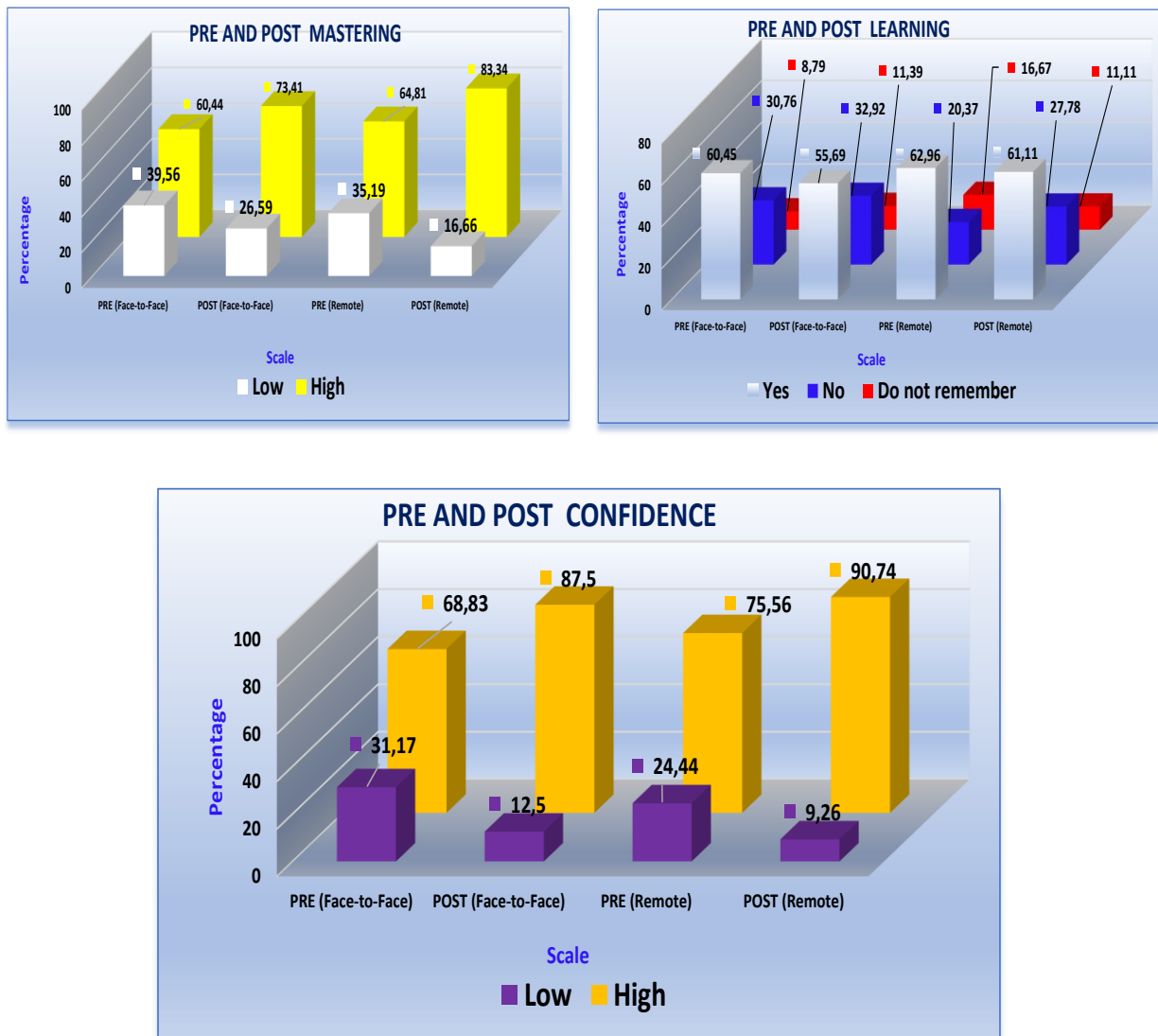
EF08CI09 – Contraceptive Methods



Source: by the author, 2022.

Figure 10 – 4th REMOTE, Mastering, Learning and Confidence.

EF08CI10 – Sexually Transmitted Infections



Source: by the author, 2022.

Figure 11 – 5th REMOTE, Mastering, Learning and Confidence.

As it is possible to see from the previous tables, graphs and figures, the spectrum of dominance varies among the different abilities, where the ability EF06CI08 VISION AND ITS DISEASES was low mastered by approximately 77.17% of the students before the UC Face to Face, and after only 38.75% declared low dominance in the ability. On the other hand, EF01CI04 ANATOMICAL DIVERSITY was high mastered by approximately 85.87% of the students in before and 90.25% after the UC.

The abilities learned during primary and secondary education also varied considerably, but with a narrower range compared to dominance.

The variance of high confidence of the students in teaching the abilities was narrower than dominance and learning because the students demonstrated low confidence in teaching. For example, the ability EF01CI03 BODY HYGIENE was declared as the highest dominated by the students (88.75%) and only 38.75% of the students stated that they feel confident or very confident in teaching that ability.

Figures 12A, B, C, D, E and F shows a comparative analysis for mastering, learning and confidence of the students that attended a face-to-face a remote human body course. It is possible to observe that the mean capability of mastering was approximately 50% for the abilities considered as the highest mastering, which was significantly increased to 72.48% after the exposure to the face-to-face human body course (pre 49.97 ± 17.11 versus post 72.48 ± 11.69 , $p < 0.0001$). Conversely, the abilities with low mastering decreased significantly by 45.10% (pre 50.11 ± 16.92 vs post 27.50 ± 11.68 , $p < 0.0001$) Figure 12A. Similarly, students exposed to a remote course of human body significantly increased their perception of mastering after the course (pre 53.79 ± 16.43 vs post 83.26 ± 10.97 , $p < 0.0001$). The same pattern was observed to the abilities considered as low mastering, which was significantly reduced by 36.24% (pre 46.21 ± 16.42 vs post 16.75 ± 10.96 , $p < 0.0001$) Figure 12B.

As shown in figure 12C, the mean abilities learned during primary and secondary education did not change after the exposure to the face-to-face course. Approximately 47% of the students stated that they had learned the abilities prior to the course. As expected, after the course the average of abilities considered learned did not change. Considering that the question referred to the learning of an ability during primary and secondary education, the fact that the students were exposed to an anatomy and physiology course should not have impacted their previous learning status or perception of the content learned. However, the remote group stated they had learned 52.49% of the abilities and after their perception significantly reduced to 38.22% (Figure 12D). Indeed, we believe that the students initially overestimated their perception of learning. The perceived learning was not statistically different between the results of face-to-face and remote post course.

Figures 12A, 12B, 12C, 12D, 12E and 12F – Students' percentage answers according to their perceptions regarding the mastering, learning and confidence of the BNNC abilities related to the human body. A) Students' responses for their perception of more and less mastering before and after the face do face course. B) Students' responses for their perception of more and less mastering before and after the remote course. C) Students' responses for their perceived learning in primary and secondary school before and after the face to face course. D) Students' responses for their perceived learning in primary and secondary school before and after the remote course. E) Students' responses for their perception of more and less confidence before and after the face to face course. F) Students' responses for their perception of more and less confidence before and after the remote course. Data presented as boxplot depicting median, minimum and maximum. (+) abilities considered as high mastering and (-) abilities considered as low mastering. * $P < 0.05$.

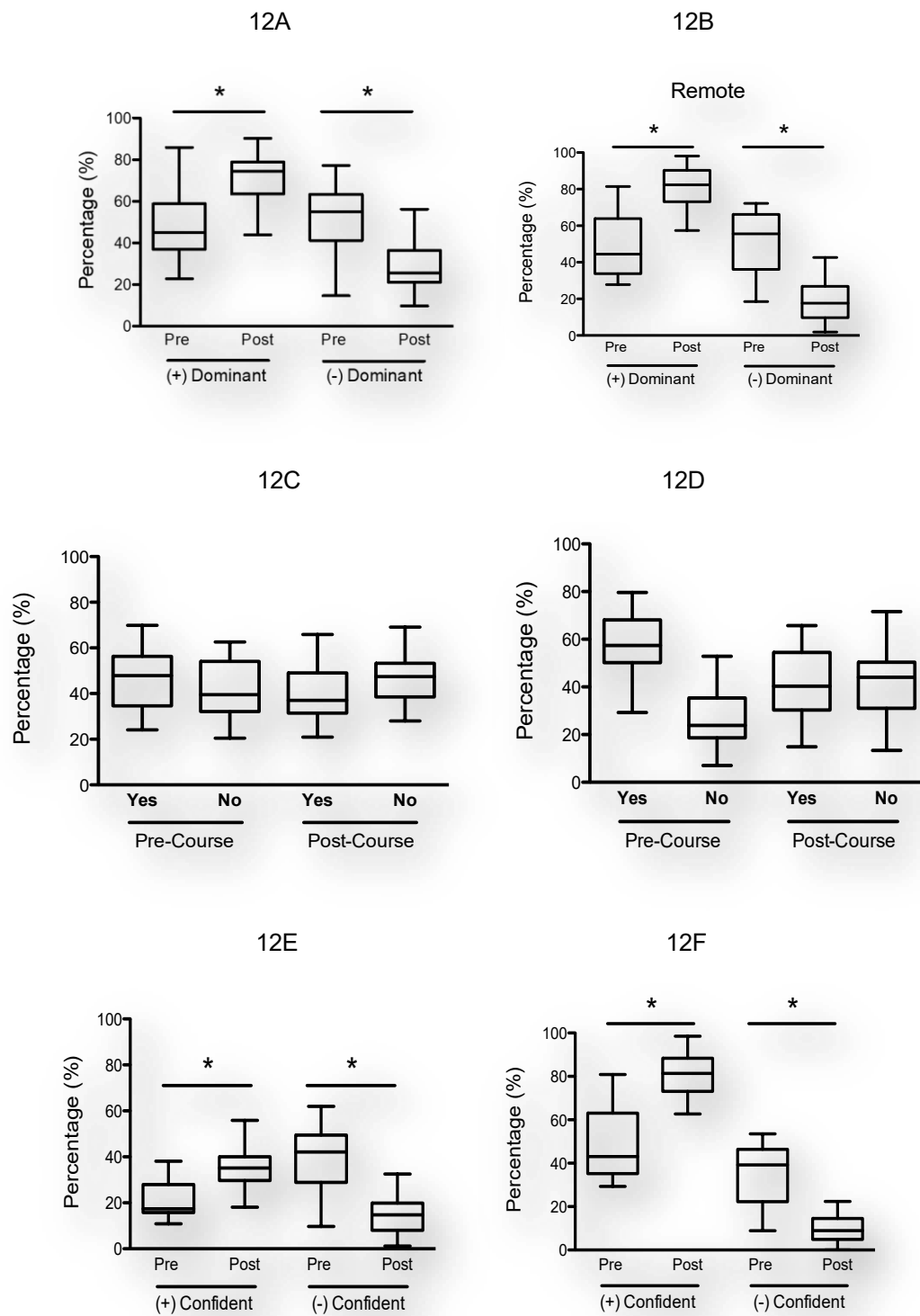


Figure 12 – Students’ percentage answers according to their perceptions regarding the mastering, learning and confidence of the BNNC abilities related to the human body.

6 DISCUSSION

In the article “Continuing formation of basic education teachers: conceptions and challenges from the perspective of teachers”, the authors Araújo, Silva and Silva⁽³¹⁾ pointed that continuing teacher education is mentioned in Brazilian legislation, given that its social and academic relevance. In service, teachers have the right to continuous training, understood in this work as a process that develops throughout the profession, being offered by the school institution, by the system in which it operates, or sought by the teachers themselves. However, government investments in actions that strengthen the teaching conditions on a daily basis, not limited to punctual and emergency actions, should be taken as the central axis in the proposals for improving the quality of education. Considering, further, that these formations necessarily need to be in line with the school's objectives, they should be clearly explained in the political-pedagogical projects as mandatory needs for teacher training.

The expression “continuing education” becomes well known in Brazil, from the second half of the 1980s, according to Pereira (2010), and there were until that time, the expressions initial or pre-service and continuing education or in service, to designate the training processes experienced by teachers, which does not represent the Brazilian reality, because at that time, in the country, there was “a great contingent of people who, upon entering a training course or program professor, in a higher education institution, had already been working in the teaching profession for several years”.⁽³²⁾ (p.1)

From our results and own teaching experience, it comes the inference that Initial training offers few opportunities for building knowledge related to practice, and basically considering the stages, what happens are simulations of educational situations, whether real (examples from third parties) or imaginary. The fact is that the school routine is marked by concrete events/problems and, many times, unpublished, in which the professors are summoned to solve. So, the importance of providing teachers, beginners and experienced, with opportunities to collectively think about the challenges and/or conflicts that permeate their practice and the search for possible interventions is mandatory. It is essential to have continuous

training that awakens a critical attitude, working in a team and receptivity to unexpected events “since the initial formation must prepare for a profession that requires the teachers to continue studying throughout their professional life”.⁽³³⁾ Graduation, therefore, is not enough, because teaching requires constant updating in all areas of knowledge, methodology, social, economic, and political reality, among others. The importance of continuing education or professional development is supposed to be understood as a training process that develops throughout the profession, being offered by the institution in which it works, or sought by the professors themselves, either individually and/or collectively, in formal or non-formal moments, mainly from the perspective of teacher professional development. About continuing education:

[...] every debate about initial and continuing education of male and female teachers needs to strongly permeate the challenges of the theory/practice relationship that underlie the ontological question of being a teacher of the educator and the need to deepen the policies that deal with this question is a key factor for us to think about training as a sine qua non condition for the transformation of the school, of the teaching reality and, above all, of education as an emancipatory issue from social inequalities.⁽³¹⁾ (p. 17)

There are several reasons for the paucity of research on the development of teacher content knowledge over periods. In the case of teacher content knowledge, a major concern is the sensitivity of teachers who can find repetitive probing threatening, reflecting disrespect for their professional credentials, particularly so for experienced secondary school teachers who are expected to be subject experts. Consequently, teacher cooperation beyond their pre-service courses is not easy to obtain and sustain. The modest number of studies on content knowledge, not just in science, may also reflect limited interest of educational researchers.^(34,35) Furthermore, the implementation of our Common Core National Standards (BNCC-2017) will be, during at least the next decade, a great challenge for all involved in the education process in Brazil.

The findings of the present study support the idea that the curriculum, in our case, the suggested curriculum by BNCC can be also an agent for positive change.⁽³⁶⁾ A teacher whose subject-matter knowledge becomes a slavish copy of the

curriculum is unlikely to welcome change, and more likely to adhere to routine lesson plans, including discouraging of divergent student questions that – as shown earlier in the descriptions of BNCC development of competences with pedagogical itineraries – can trigger both student and teacher learning.⁽³⁷⁾

Just as a reminder, according to Shulman (1986) differentiation among categories of teacher knowledge, “*Subject matter knowledge* is that comprehension of the subject appropriate to a content specialist” (p. 26). This calls for clarifications as to what are the boundaries of “the subject” and what is “appropriate comprehension.” For our research purposes, having in mind that the *sine qua non* design is repeated collection of the same data from the same persons, it was necessary to limit the scope of what is followed-up and how it is done.⁽⁵⁾

In our study we attempt to assess the prior knowledge of freshmen in a higher education course for science teachers in relation to the human body and its physiology, based on what the BNCC lays down through the twenty abilities related to the theme and try to understand the reasons why the opinion of our controlled respondents had increased positively by answering to the same type of questioning after going through a discipline focused on teaching the human body and its physiology, remembering that fundamental education in the final series in primary school in Brazil is composed of the 6th to 9th grade, and in this level of education it is important for the teacher to focus on human body and health. By working on the human body at this level, it is possible to introduce students to the functioning of the body and its organs and systems.

Regarding the results presented, it is possible to infer that, in relation to the general contents, the children are supposed to be literated, learning the domain of the spoken and written language, the mathematical principles, the notion of space and time, the scientific principles, in addition to having a contact with the art and aesthetics in this and that, in addition, it is a stage in which students' beginning of scientific literacy takes place. The teaching of human anatomy effectively begins in the 8th year of Elementary School, and it has been associated with “practical classes” mediated by extension actions. With the implementation and unification of the national curriculum via BNCC, the teaching of the human body and its physiology in basic education proved to be an educational and training need for

citizenship, as it promotes the teaching of the development of good habits, care with the prevention of possible diseases and various benefits. In early childhood education, it is essential to know the body, also the collective and individual safety concerning to health and citizenship.

The BNCC makes clear the importance of the body, gestures, and movement as it establishes that, in the first stage of Basic Education, six rights of learning and development must be ensured: expressing, getting to know each other, playing, participating, living together, and exploring. The educational process in this way proves to be fundamental, since discussing the body, its physiology and function in Basic Education enables not only reflection and questioning about the historicity and manifestation of the body and body culture, but also the formation of good citizens.

When we take a look at the abilities presented in this study as *low Mastering* and *low confidence to teach*, we realize how fundamentally important it is for children to promote the construction of their own identity and self-image, either through knowledge of their body, thus as developing motor ordinary skills such as rolling, walking, running, jumping, dancing, tearing, being cut, and being aware of body care, adopting hygiene habits and developing a critical sense, proving the idea that knowledge of the body is of fundamental importance for students to have understanding in relation to their body and even in relation to bodily changes over time and their physical and intellectual maturation.

It is in this sense that the understanding of the body corresponds to considering the totality of the human being, in which all dimensions: physical, intellectual, psychological, ethical, affective, moral, social and cultural, all of them complementing each other in a single being. And the corporeity is our presence in the world. It is the way in which the relationships and interactions we establish with each other and influence the world, contributing to our formation as human beings.

Yet, understanding how this comes to guide our performance in society, in short, is the look at how our being survive in the world. We believe that the school, as well as the family, among other coexistence nuclei, make up the context of human being formation. Therefore, it is from this context of relationships that a child learns to live in society, and to put himself in the place of the other, respecting differences, building ethical and moral values and, therefore. It is in early childhood education,

in which perception and understanding of their own body are fundamental, as the children have their first contact with people different from their family nucleus, expand their relationships and social interactions and, in these interactions, they compare, perceive differences, explore their limits and potential and, furthermore, they learn.

The results presented regarding the levels of *low mastering* and *low confidence to teach* the themes related to the human body and its physiology lead us to think and question the strategies that have been used for teaching the human body and its physiology. How to make an effective teaching approach of the human body? The clearest hypothesis we could consider is that new pedagogical strategies, such as those suggested by the BNCC, are necessary, as well as new educational actions in the face of the teaching-learning process. Understanding the principles of the learning process is essential for educators and parents, because based on this understanding, problems that occur in this area will be treated and resolved without trauma or blockages.

About the learning process, it is worth remembering that Vigotsky considers that only in the encounter with the other, the man came to be perceived as a rational being, as the formation an individual is only possible through a “mediation carried out through the other”.⁽³⁸⁾ Despite the child's teaching-learning process not starting in the school environment, it is extremely important that the child attend school, as this space introduces new elements in their development, presenting the other. According to Vigostky's ideology, learning and development are interrelated from the first day of a child's life. It was based on this idea that the author developed the concept of *Zone of Proximal Development* and *Zone of Real Development*, teaching that “real development is the part that refers to retrospective development, while the zone of proximal development points to the perspective of mental development”.⁽³⁸⁾

On the theme of the human body and its physiology, and in light of the evidences that the respondents in our survey have shown a *low level of mastering and confidence in teaching*, we must emphasize that teaching the human body is extremely relevant for the proper students formation of, leading to the consideration that it is important to have adequate knowledge and understanding of the complexity of one's own organism, dynamic, voluntary and involuntary, with the capacity to

generate new lives and to do more interesting things, however, unfortunately, this type of teaching is not very efficient during on a day to day basis in the class room, becoming something of little importance. This type of problems results from the combination of different factors as we have already discussed, which are ignored on several occasions. In addition, textbooks incessantly treat the human body as a junction of parts, making the students not adequately understand the fact that we are a single organism, with various chemical reactions and activities that occur at the same time. The PCNs, thus, advocates on the subject:

In order for the student to understand the integrity of the body, it is important to establish relationships between the various vital processes, and between these and the environment, culture, or society. It is these relationships that are expressed in the architecture of the body and make it a totality. Discerning the parts of the human organism is often necessary to understand its particularities, but its isolated approach is not enough to understand the idea of the body as a system. Therefore, when focusing on human anatomy and physiology, it is necessary to select contents that allow the student to understand the body as an integrated whole, not as a sum of parts.⁽³⁹⁾ (p. 45).

Notably, we must also observe that the conceptions of the human body are made in a kind of personal way, being the consequence of influences from the historical context, where the student is inserted. In this way, it is possible to find different conceptions that cannot be considered right or wrong without being discussed in the educational institution. In the course of human history, various conceptions of the body and bodily behaviour have been and still are elaborated, which may be subject to social and sentimental values. In this sense, the conception of the body tends to be individual and not general. Then, we ought to see:

(...) the student's knowledge about the human body must be associated with a better knowledge of his own body, with which he has an intimacy and a subjective perception that no one else can have, since each body is individual, unique.⁽³⁹⁾ (p. 46).

Cicillini and Santos (2002) point out that currently, science teaching in educational institutions:

(...) is guided by the traditional teaching method, based on the transmission of content by the teacher, and the reception of this information by the student. This method does not take into account the students' previous knowledge, their experiences, and mental

conditions for learning, being required only the faithful reproduction of such information as expected by the teacher. As a result, knowledge is not effective in the classroom, with mere exchanges of information taking place, depriving the student of participating in his own learning process.⁽⁴⁰⁾ (p. 35).

However, the teaching related to the human body encompassed by the discipline of science needs to be put into practice so that the student would be able to have new thoughts about this knowledge, in a contextualized approach, in other words, take the teaching into their reality.

On another hand, according to the conception of Rabello (1994), who teaches saying about this very important issue:

(...) the study of the human body instigates students, encourages them to their gaze to their own bodies, since they are in a phase of constant change. It is up to the teacher to take advantage of such moments to understand the notion of the human body that his students have and based on this information, direct his teaching so that he can respond to his students' questions.⁽⁴¹⁾ (p. 74)

It should also be noted that in most schools,

(...) the study of the human body is involved by a logicist approach that corresponds to a path in which one starts from the simplest and arrives at the most complex, importing the logic of the content and not that of the student. This teaching perspective is possibly based on the teacher's social representation since, in this, there is an emphasis on the physical dimension of the human body.⁽⁴²⁾ (p. 8).

In this way, we ought to understand that, in the light of the results presented in our research, it is necessary to encourage the student to ask questions regarding to human physiology and/or anatomy, in order to seek for answers that would solve these questions, allowing them to be able to having greater notions about their body, as an integrated whole and being able to adequately articulate their lives with the physical and social environment in which you are inserted.

Therefore, it is very relevant to properly acquire knowledge regarding the human body that is directly associated with the notions of health and with the contents associated with the individual's self-care. It is possible to mention, as an example, the knowledge that enables students to analyze their sense organs, the structures that are responsible for organs, most varied sense organs, then combine

their hygiene practice with basic care, thus aiming to conserve the correct functioning of the referred organs and their self-knowledge.

Evidently, there are some obstacles when teaching science, due to the use of technical terms. However, it is necessary to have adequate mastering of the aforementioned scientific language, a situation in which any science topic requires detailed knowledge about the correct nomenclatures. But, as Luvizoto (2011, p. 48) teaches, we can see that in cases of a “methodology that defends the study aimed at scientific culture, the ideal is to help build knowledge that favours the understanding of what the student experiences and “not knowing by heart the number of bones or their names”.

According to the studies by Malafaia and Rodrigues⁽⁴³⁾, we can see that while new educational strategies are elaborated and practiced, new active methodologies of teaching and learning, always considering the students peculiarities, this teaching-learning process becomes increasingly more efficient and a pleasant day for the student.

Therefore, among the numerous alternative teaching methodologies, we can highlight games, models and modeling, schematic and dynamic representations / drawings, because even all of these have relevant and specific peculiarities, in a general context, they all present the same ultimate goal, which is to make knowledge more accessible and meaningful to students.

Moreover, studies made by Franco and Carvalho⁽⁴⁴⁾ and also research by Nascimento et. al. (2015), showed that the didactic models are similar to a figurative system that reproduces reality in a specialized and concrete way, transforming teaching into something easier for the student to understand, thus achieving a more efficient the learning process, taking into account that the student experiences numerous types of challenges, either having the ability to solve problems using their creativity and imagination.

Thus, making it very clear the need to rethink the ways that would be the most appropriate pedagogical practices aimed at the discipline of science, related to the study of the human body in the initial and continuing education of future science teachers, as they can directly influence a diversity of factors that ought to

affect the educational praxis and are also directly related to the students' teaching-learning process.

This study, taking in consideration that the respondents effectively had significant Improvement in their abilities of *mastering* and *confidence in teaching* such subjects after passing through a course well-structured in teaching the human body and its physiology, showed the indications that we must take into account the demand for the creation of new approaches and alternative methodological options to the traditional one, which may provide a maximization of the effectiveness of learning and teaching science and biology, either being a more important and relevant knowledge construction process for the students' lives or for the professionals who are involved in that process, especially taking into account a more globalized world and relevant scientific and technological advances that can influence both the environment and people's health, also influencing positively the students' willingness to learn.

7 CONCLUSIONS

The conclusion criteria, since the conclusion is “a factual statement about what has been investigated, analyzed, interpreted; it is a commented synthesis of the essential ideas and the main results obtained, made explicit with precision and clarity”⁽⁴⁵⁾, and to make the analysis of the conclusion more objective, 3 important points were used and without hierarchy of importance: 1) the conclusion was objectively made based on the data collected, that is, the data collected and presented support the conclusion; 2) the conclusion at least mentions whether the data obtained prove or disprove the hypothesis and 3) reasoning or reflections based on possible physiological explanations for the observed results were used.

As the Common Core National Standards BNCC (2017) was recently implemented and a curricular adequacy that would promote greater learning on the subject in the basic training of the future science teachers, the results of this research suggest that curricular policies and measures, as well as improvements in the initial training and continuing education courses for teachers of Science, have to be implemented as soon as possible.

Although the guidelines support the investigative nature of the sciences, including the human body, its implementation can still generate some resistance on the part of teachers, mainly because many investigative practices are still associated with the need for specific laboratory facilities, representing a problem for institutions of public education, mainly due to the scrapping of education resulting from the budget cuts suffered in Brazil in recent years. However, this approach is fundamental and the methodologies that promote experimentation must be addressed during practical activities, regardless of physical laboratories and so that future science teachers, notably those of Biology, when they should teach about the human body, be able to teach their classes in the best way they should.

However, before proposing any strategy or didactic tool, it is necessary to contextualize the main guidelines for the teaching of science, and the human body issues according to what is preconized in our official document, BNCC (2017), and in what way, the pedagogical aspects in the formation of higher education of Science

and Biology teachers to explore and teach these contents also impacting the basic education must be developed for now on.

The results of this study also suggest that undergraduate students who had been exposed to a well-structured discipline to promote the teaching of the human body theme, its physiology and anatomy, will achieve higher levels of mastering and will be more confident in teaching the subject as preconized in the BNCC (2017).

It was observed that both groups who participated in this research, face-to-face and remote are from similar profiles. Furthermore, considering that both groups had different teaching approaches, the first one in a classroom, interacting directly with the UC CHEF tutor, and the second group interacted remotely, we could observe that there is no difference between both ways of teaching the course.

It is believed this research can contribute to reinforce the idea that undergraduate students in natural sciences courses must have more exposure to the topics of biology related to teaching the abilities suggested in the Brazilian official document with regards to the human body, its anatomy and physiology, and this exposure should be presented in the basic education.

Finally, freshman students enrolled in the science and mathematics teacher training program have demonstrated low proficiency and confidence in teaching the human body theme as it is proposed by BNCC (2017) and the collected data and analysis in this study reinforce hardly the importance of teaching physiology to elementary and high education students.

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9 APPENDICES

9.1 BNCC – CIÊNCIAS DA NATUREZA – ENSINO FUNDAMENTAL I e II

UNIFESP UNIVERSIDADE FEDERAL DO ESPÍRITO SANTO			
BNCC – CIÊNCIAS DA NATUREZA – ENSINO FUNDAMENTAL I e II NOME _____ RA _____ Turma _____ Gênero: M () F () Outro () Idade: _____ Pretende se habitar em: () Jato () Quid () Fto ou () Mat Ensino o Fund e EM em () somente escola pública () somente escola particular () em pública e particular Fez Curinho? () Sim () Não			
Julgue os itens da BNCC e responda (EF01CI02) Localizar, nomear e representar graficamente (por meio de desenhos) parte do corpo humano e explicar suas funções.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF01CI03) Discutir as razões pelas quais os hábitos de higiene do corpo (lavar as mãos antes de comer, escovar os dentes, limpar os olhos, o nariz e as orelhas, etc.) são necessários para a manutenção da saúde.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF01CI04) Comparar características físicas entre os colegas, reconhecendo a diversidade e a importância da valorização, do acolhimento e do respeito às diferenças.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF03CI05) Descrever e comunicar as alterações que ocorrem desde o nascimento em animais de diferentes meios terrestres ou aquáticos, inclusive o homem.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF05CI06) Selecionar argumentos que justifiquem por que os sistemas digestório e respiratório são considerados correspondentes pelo processo de nutrição do organismo, com base na identificação das funções desses sistemas.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	

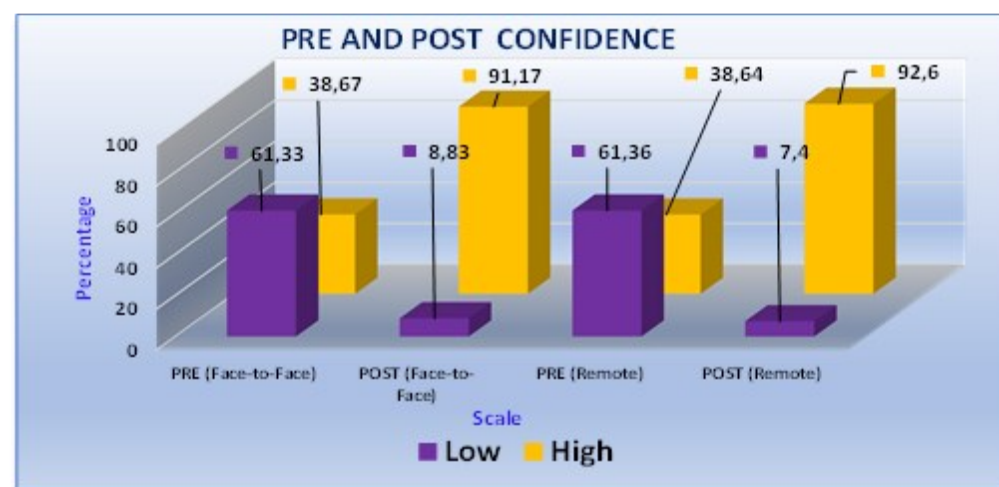
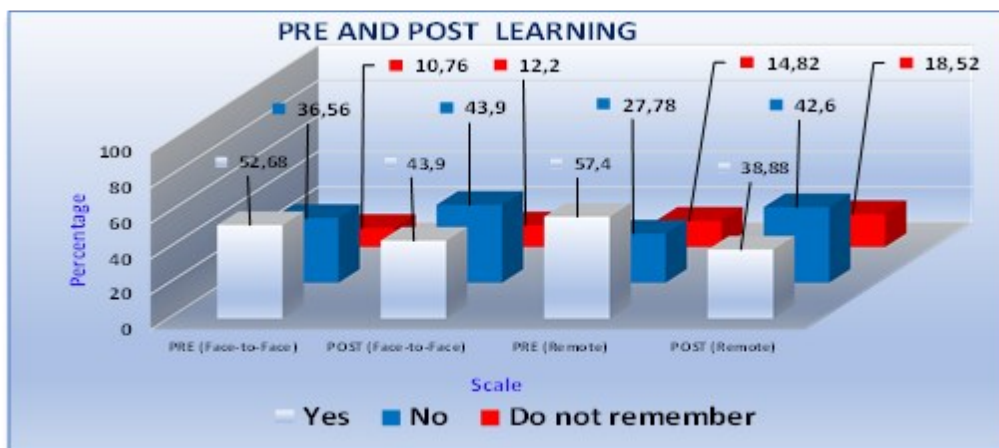
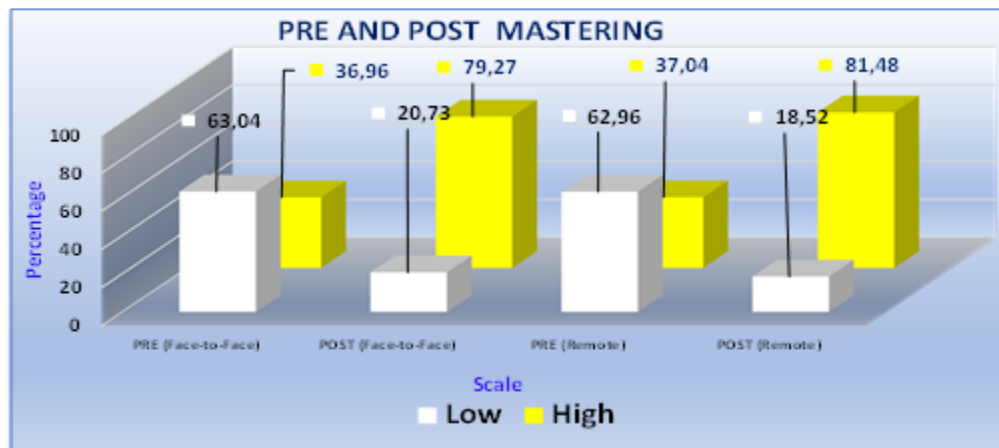
UNIFESP UNIVERSIDADE FEDERAL DO ESPÍRITO SANTO			
(EF05CI07) Justificar a relação entre o funcionamento do sistema circulatório, a distribuição de nutrientes pelo organismo e a eliminação dos resíduos produzidos.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF05CI08) Organizar um cardápio equilibrado com base nas características dos grupos alimentares (nutrientes e calorias) e nas necessidades individuais (atividades realizadas, idade, sexo, etc.) para a manutenção da saúde do organismo.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF05CI09) Discutir a ocorrência de distúrbios nutricionais (como obesidade, subnutrição, etc.) entre crianças e jovens a partir da análise de seus hábitos (tipos e quantidades de alimento ingerido, prática de atividade física, etc.).			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF06CI06) Concluir, com base na análise de ilustrações e/ou modelos (físicos ou digitais), que os organismos são um complexo arranjo de sistemas com diferentes níveis de organização.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF06CI07) Justificar o papel do sistema nervoso na coordenação das ações motoras e sensoriais do corpo, com base na análise de suas estruturas básicas e respectivas funções.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	

UNIFESP UNIVERSIDADE FEDERAL DO ESPÍRITO SANTO			
(EF06CI08) Explicar a importância da visão (captação e interpretação das imagens) na interação do organismo com o meio e, com base no funcionamento do olho humano, selecionar lentes adequadas para correção dos diferentes defeitos da visão.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF06CI09) Deduzir que e estrutura, a sustentação e a movimentação dos animais resultam da interação entre os sistemas muscular, ósseo e nervoso?			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF06CI10) Explicar como o funcionamento do sistema nervoso pode ser afetado por substâncias psicoativas.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF07CI09) Interpretar as condições de saúde da comunidade, cidade ou estado, com base na análise e comparação de indicadores de saúde (como taxa de mortalidade infantil, cobertura de saneamento básico e incidência de doenças de veiculação hídrica, atmosférica, entre outras) e dos resultados de políticas públicas destinadas à saúde.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF07CI10) Argumentar sobre a importância da vacinação para a saúde pública com base em informações sobre a maneira como a vacina atua no organismo e o papel histórico da vacinação para a manutenção da saúde individual e coletiva e para a erradicação e doenças.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	

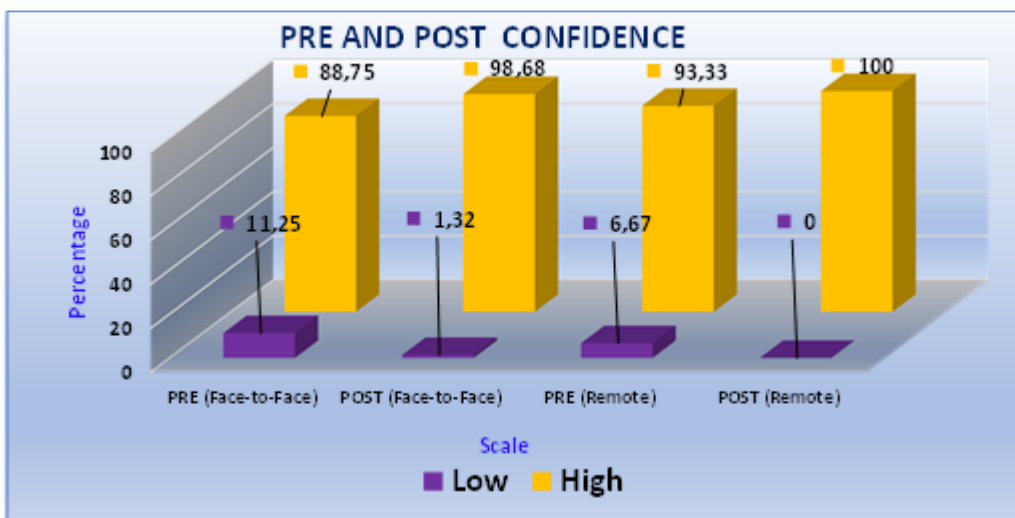
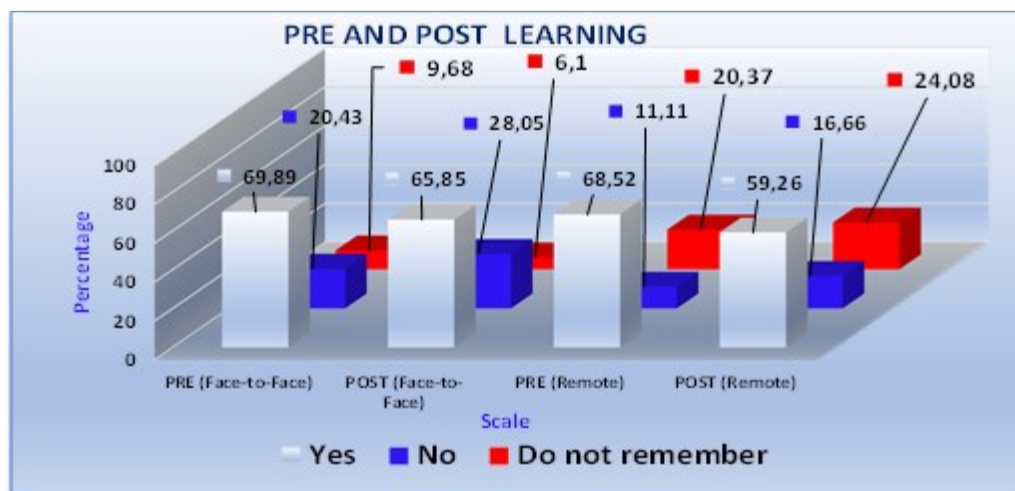
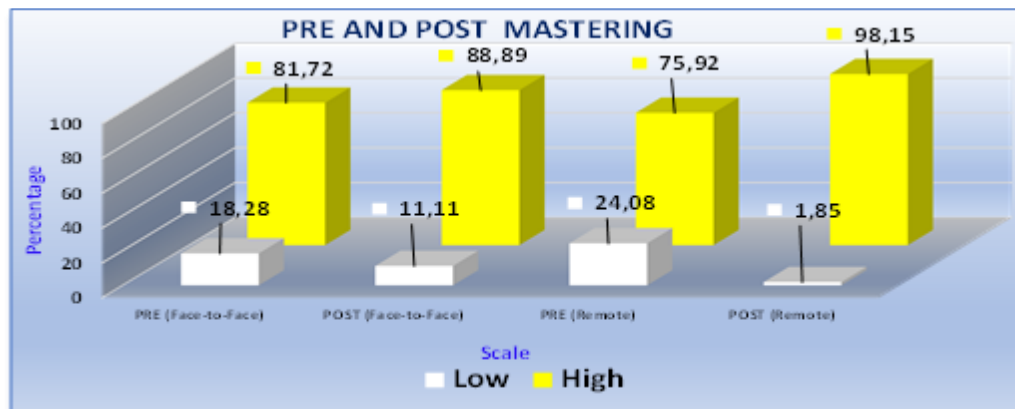
UNIFESP UNIVERSIDADE FEDERAL DO ESPÍRITO SANTO			
(EF08CI07) Comparar diferentes processos reprodutivos em plantas e animais em relação aos mecanismos adaptativos e evolutivos.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF08CI08) Analisar e explicar as transformações que ocorrem na puberdade considerando a atuação dos hormônios sexuais e do sistema nervoso.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF08CI09) Comparar o modo de ação e a eficácia dos diversos métodos contraceptivos e justificar a necessidade de compartilhar a responsabilidade na escolha e na utilização do método mais adequado à prevenção da gravidez precoce e indesejada e de Doenças Sexualmente Transmissíveis (DST).			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF08CI10) Identificar os principais sintomas, modos de transmissão e tratamento de algumas DST (com ênfase na AIDS), e discutir estratégias e métodos de prevenção.			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	
(EF08CI11) Selecionar argumentos que evidenciem as múltiplas dimensões da sexualidade humana (biológica, sociocultural, afetiva e ética).			
Você domina os conceitos fundamentais dessa habilidade? Nada () () () Muito	Você aprendeu essa habilidade na educação básica (Ensino Fundamental e Médio)? () Sim () Não () Não lembro	Se tivesse que ensinar hoje essa habilidade para um aluno da educação básica, você estaria? () Nada Confiante () Confiante () Muito Confiante () Não sei	

9.2 GRAPHS: BNCC ABILITIES – HUMAN BODY – PRE AND POST.

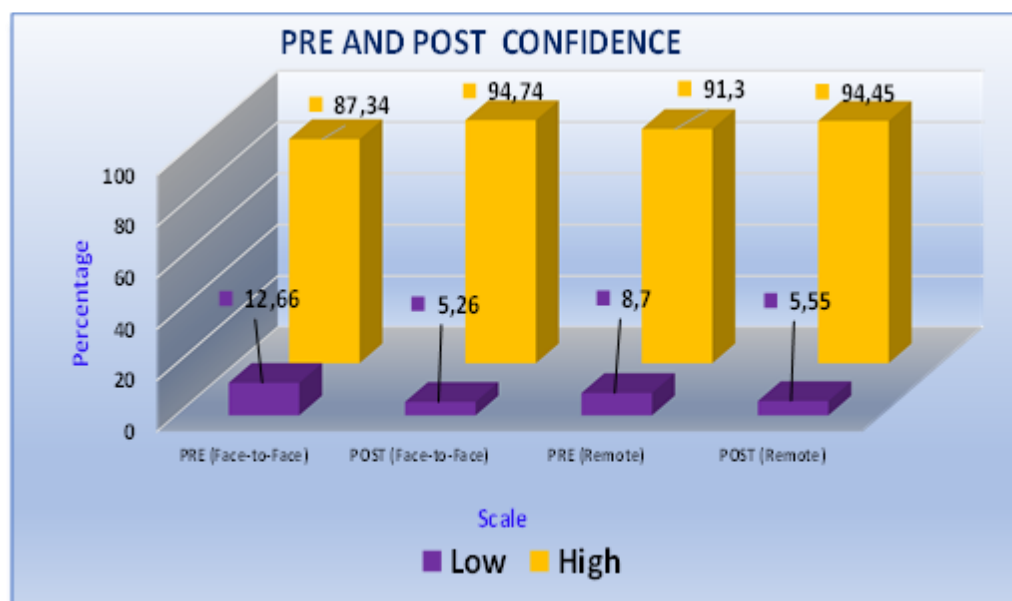
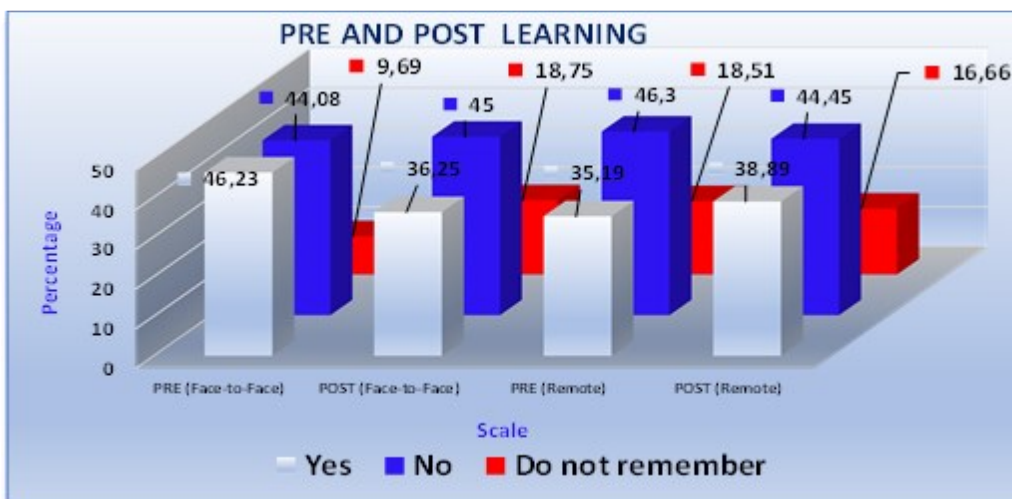
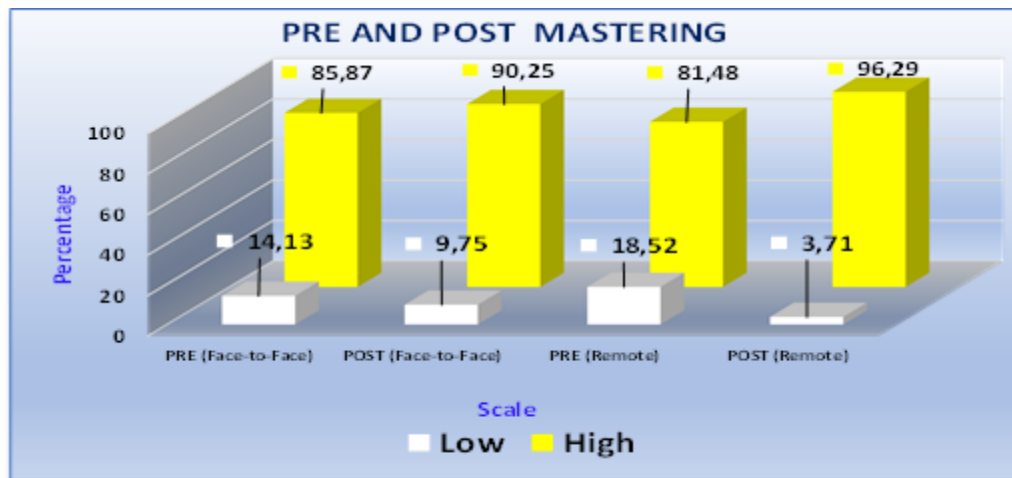
EF01CI02 - General Anatomy



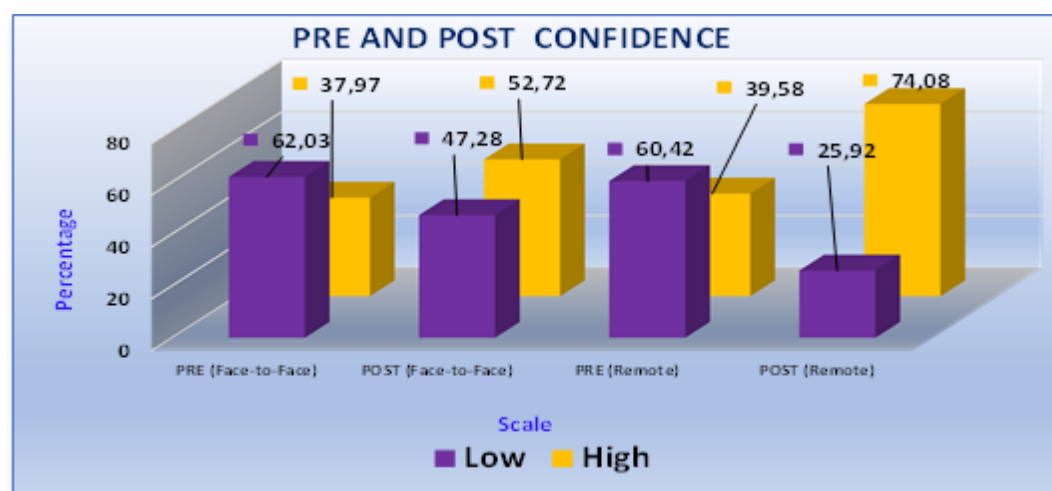
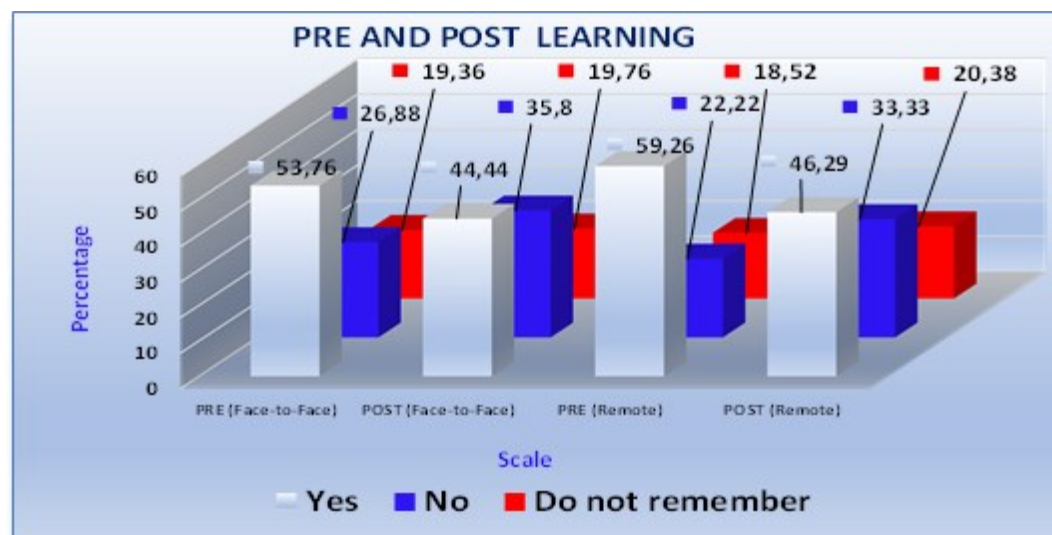
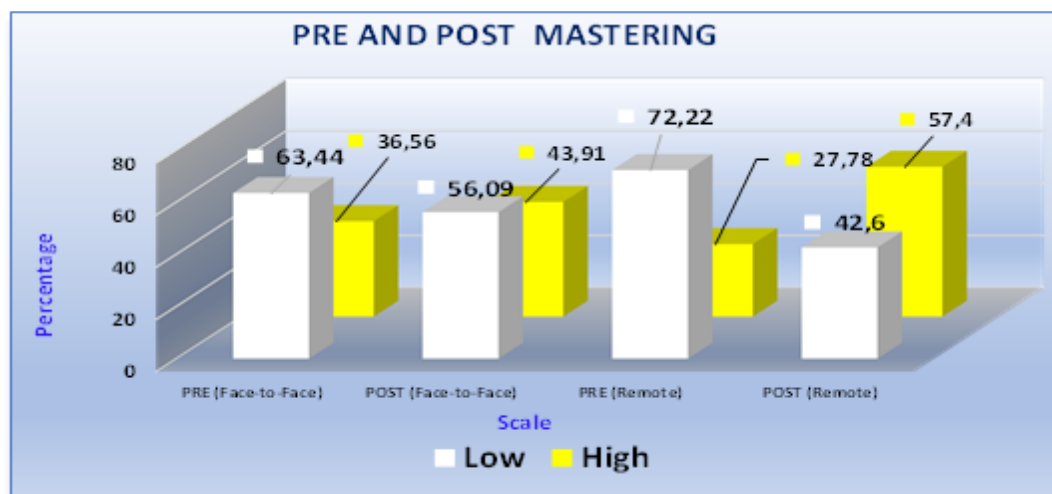
EF01CI03 - Body Higyene



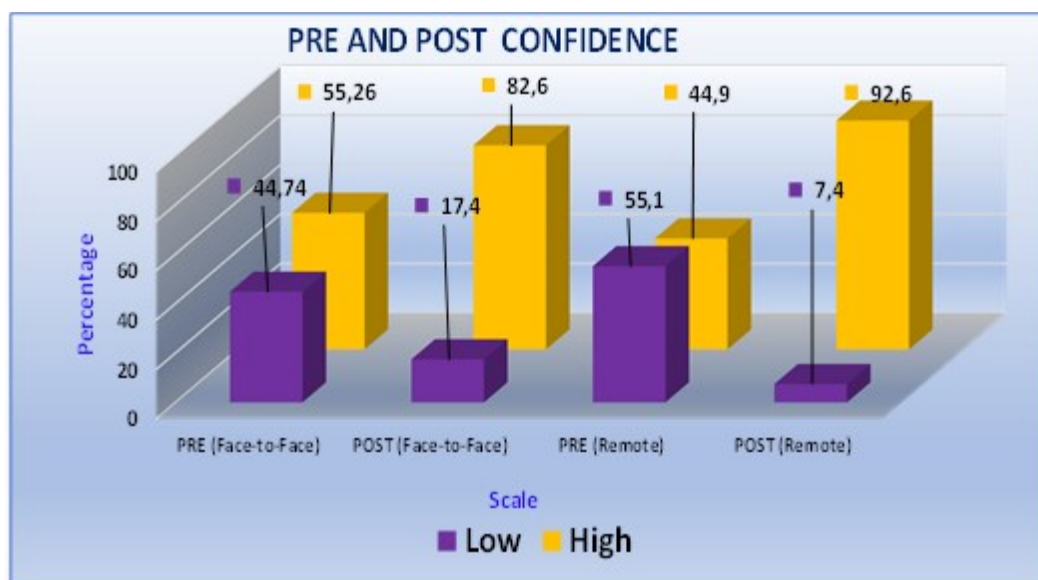
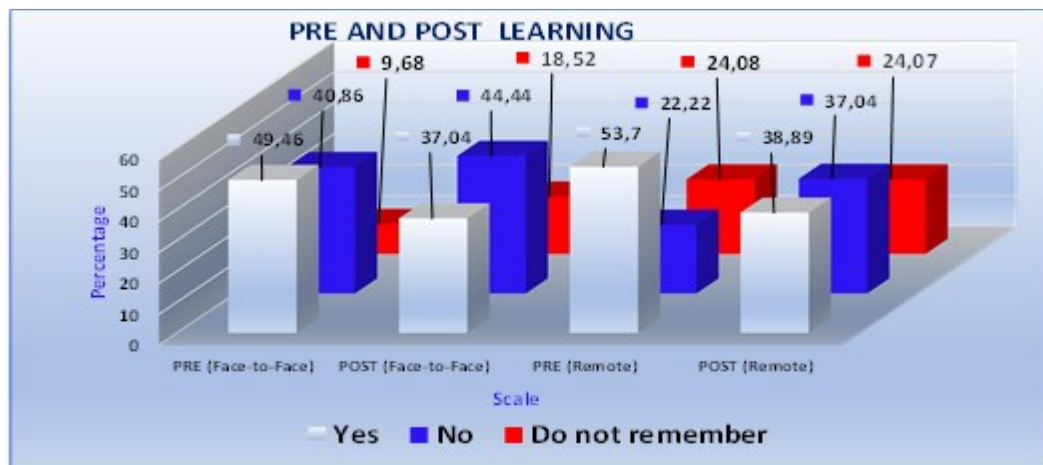
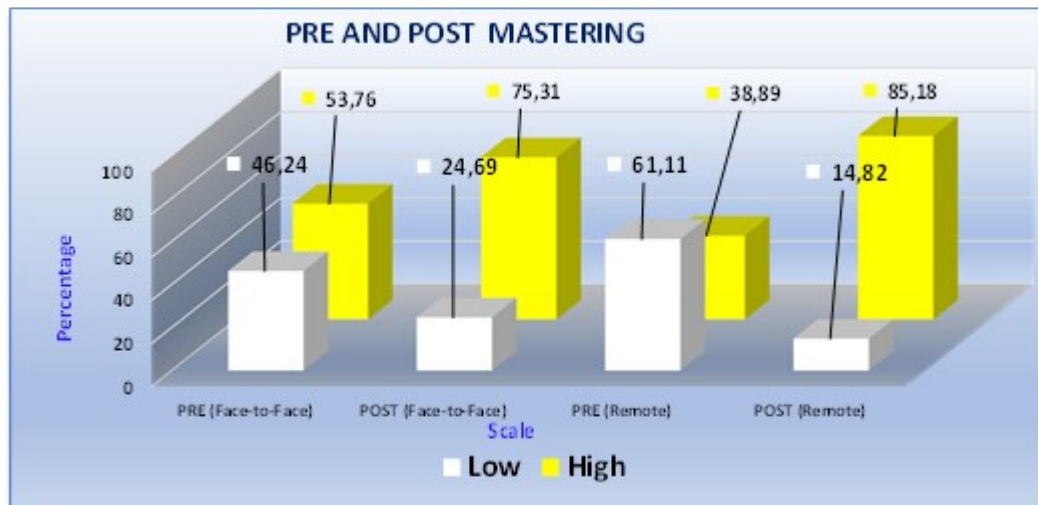
EF01CI04 - Anatomical Diversity



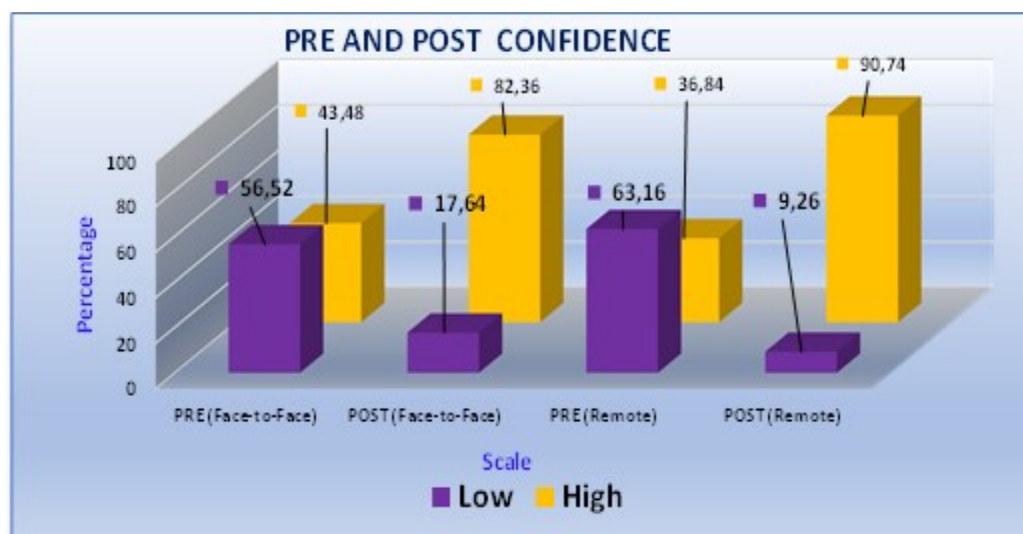
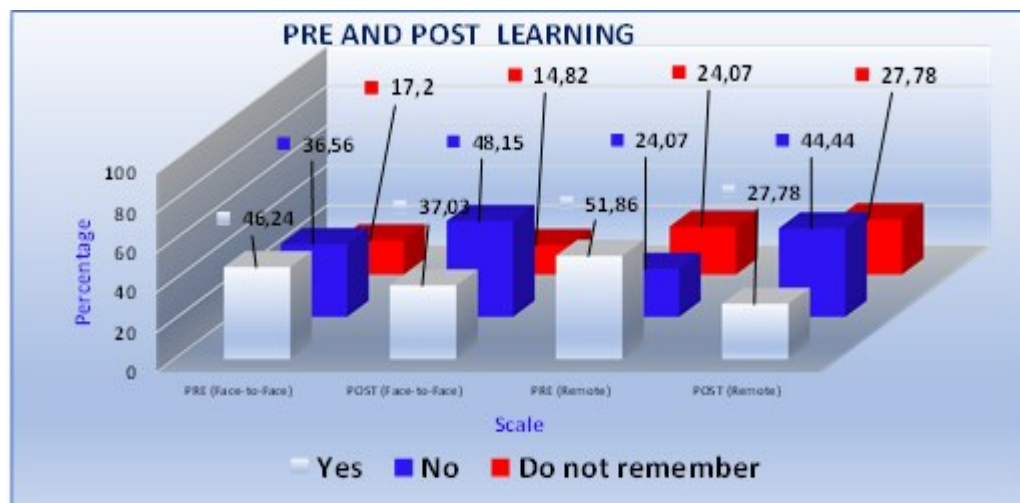
EF03CI05 - Embriology and Evolution



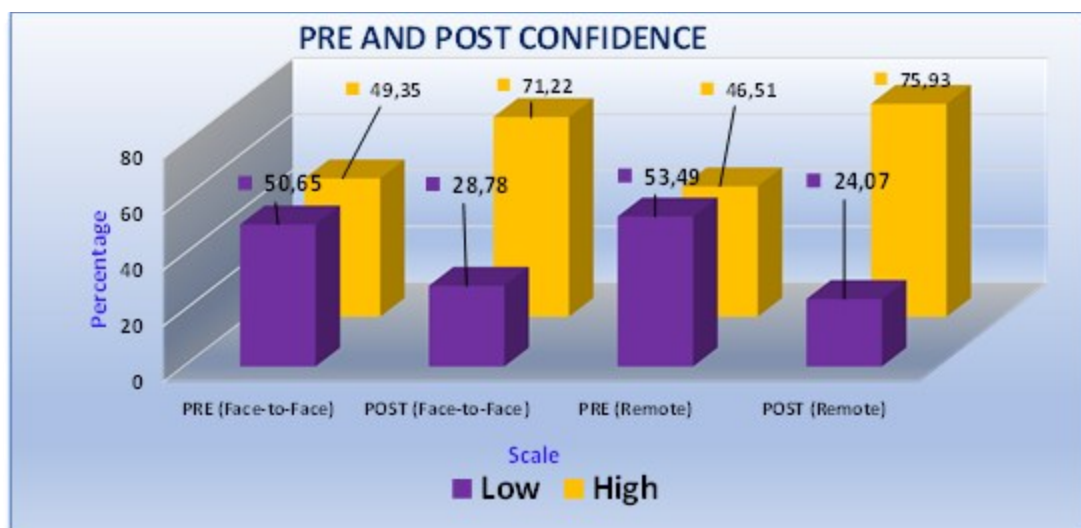
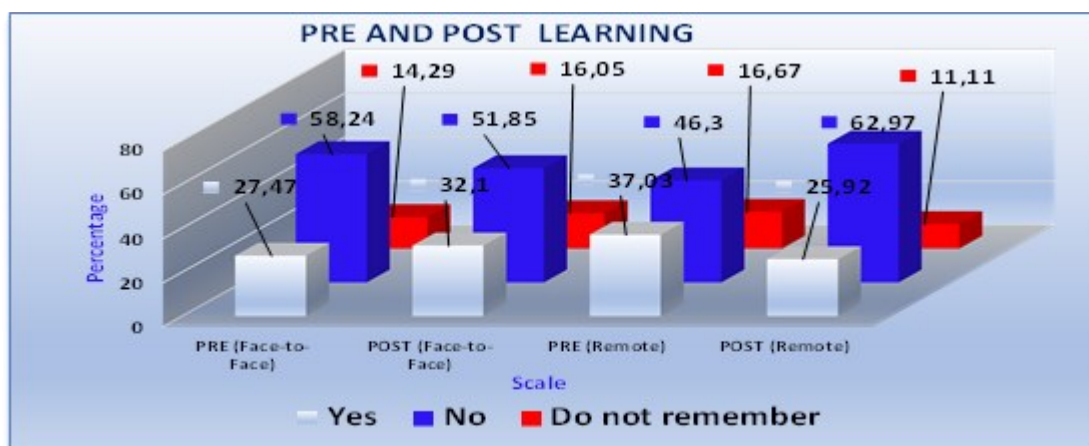
EF05CI06 - Digestive and Respiratory Systems



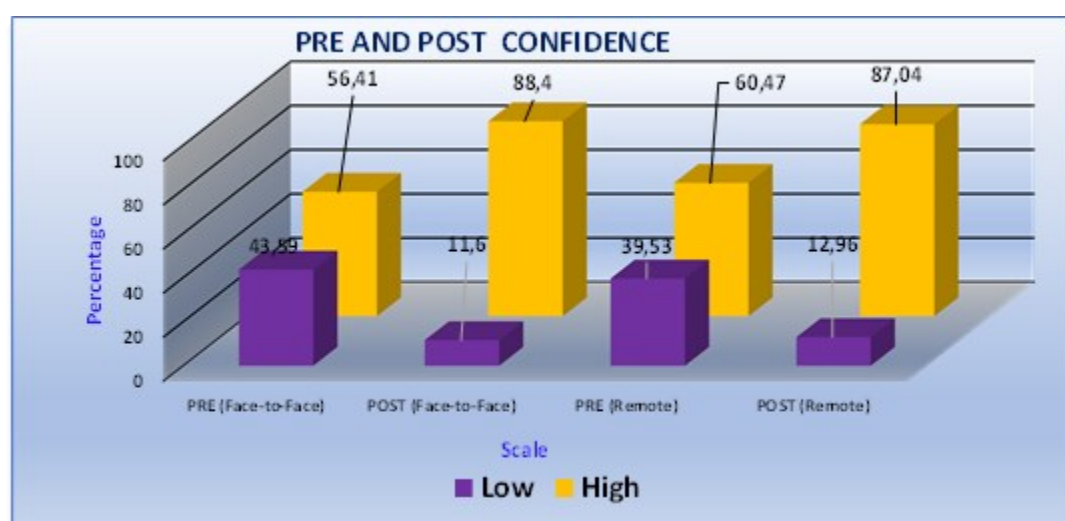
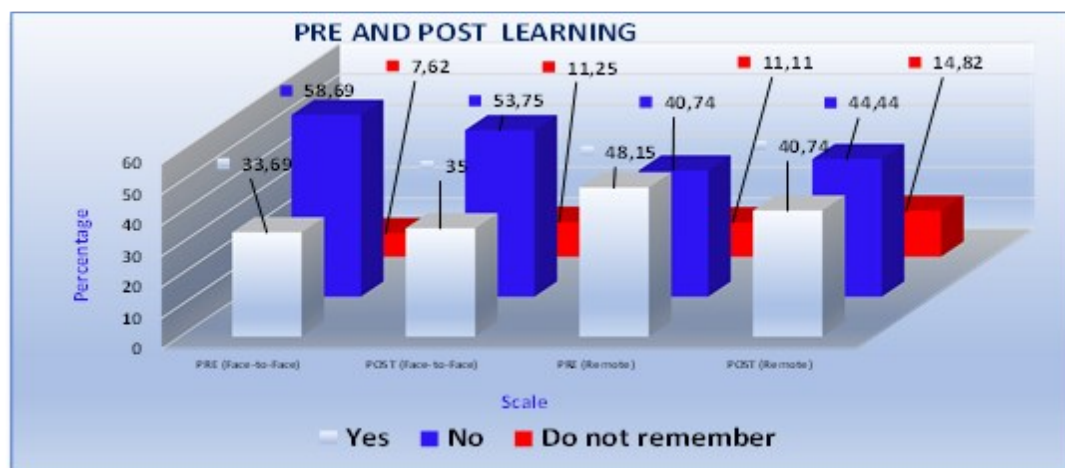
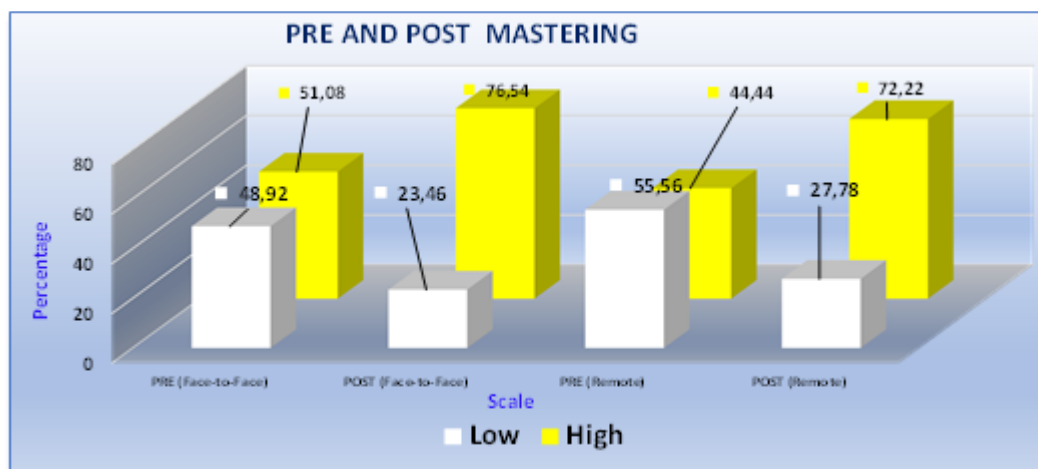
EF05CI07 - Cardiovascular System



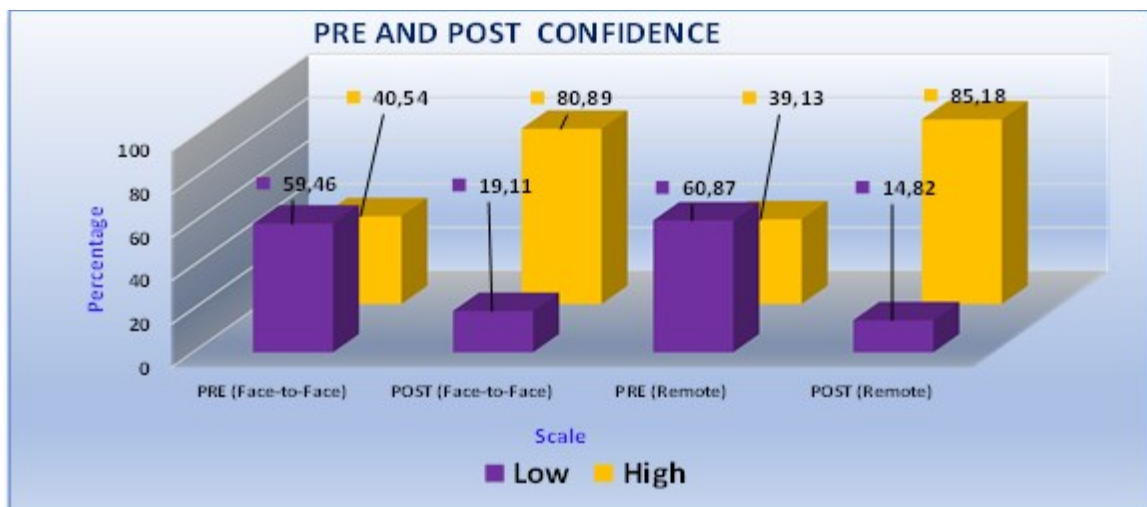
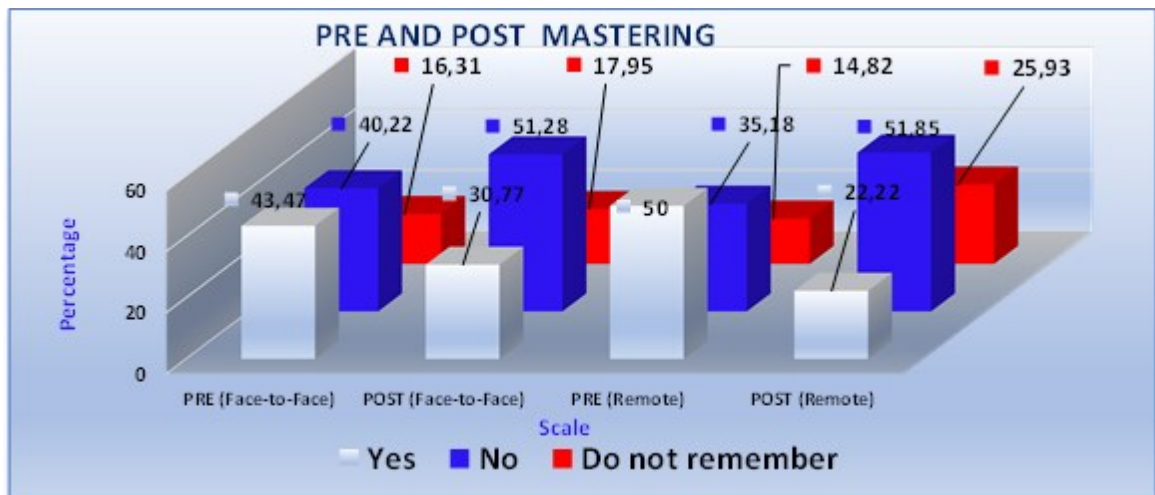
EF05CI08 - Nutrition and Health



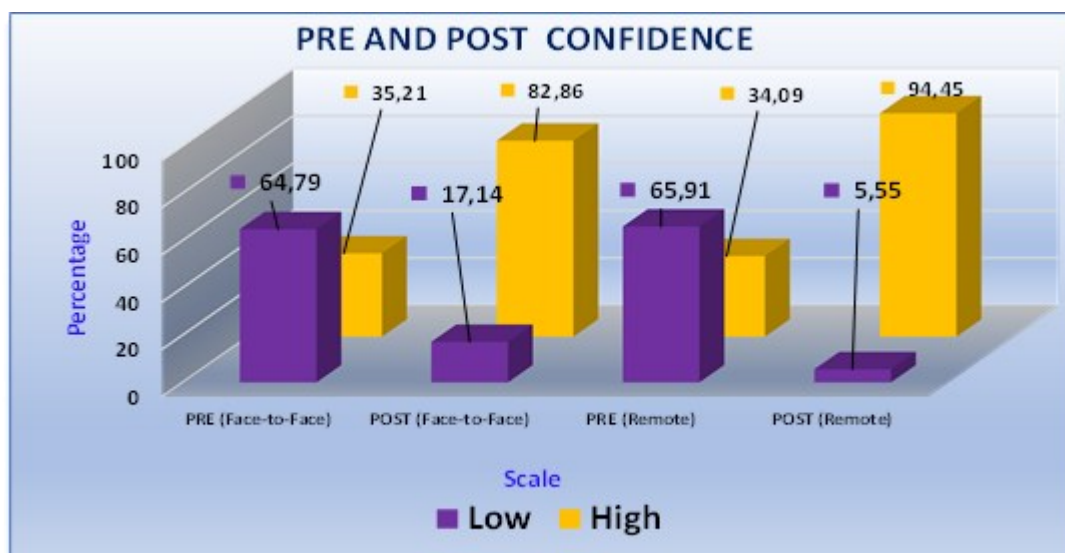
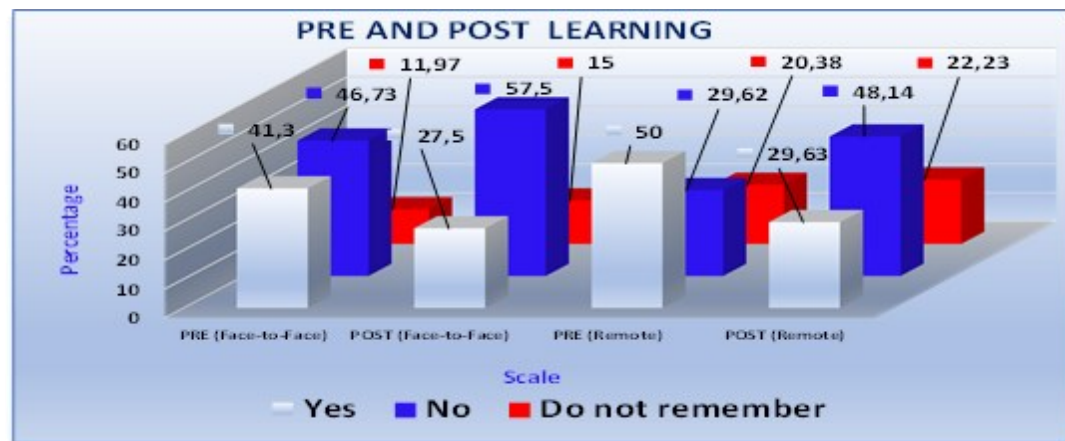
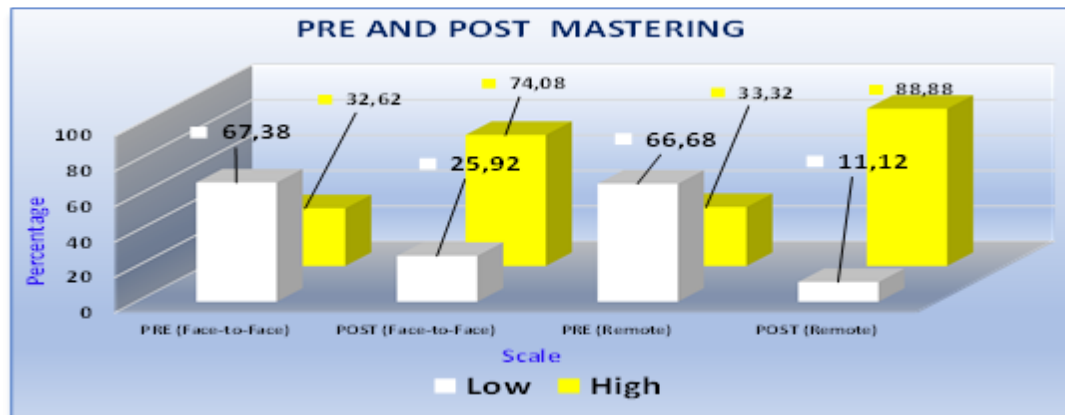
EF05CI09 - Nutritional Disorders



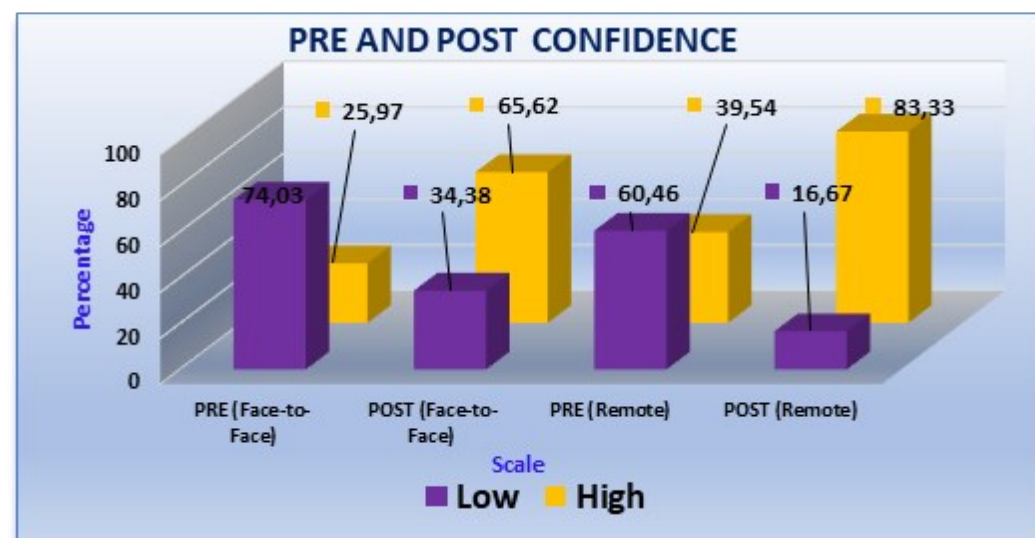
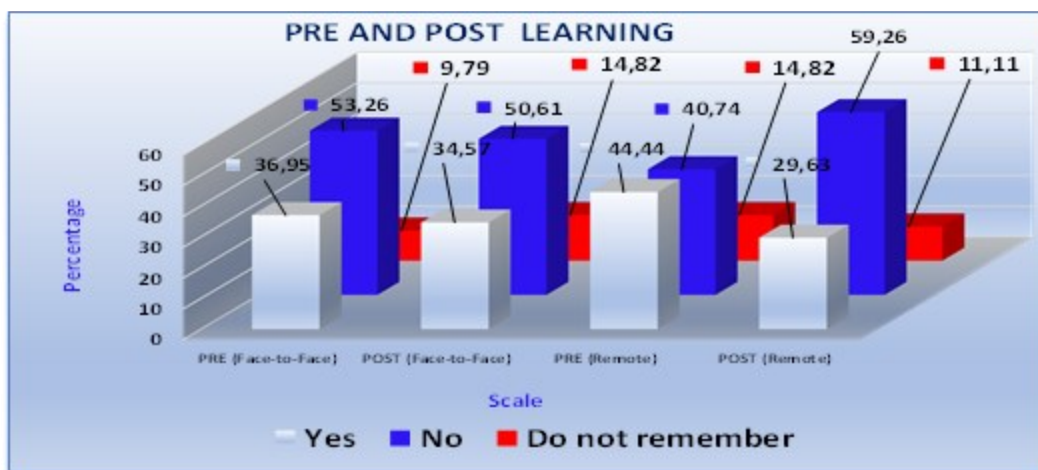
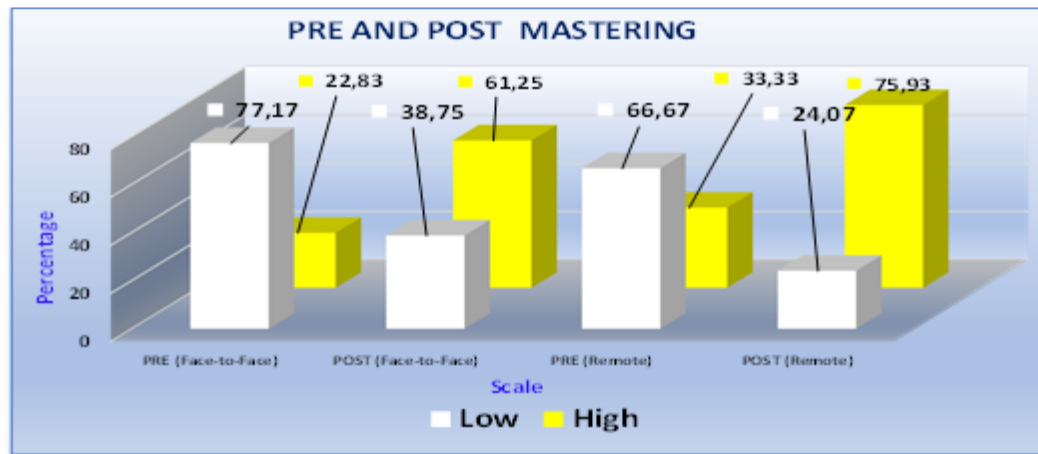
EF06CI06 - Systems Organization



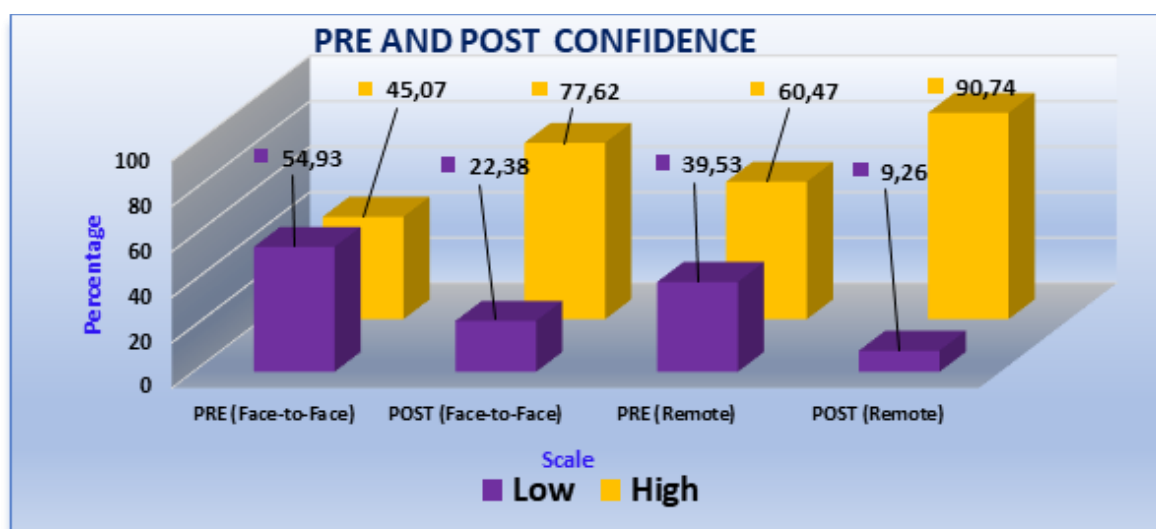
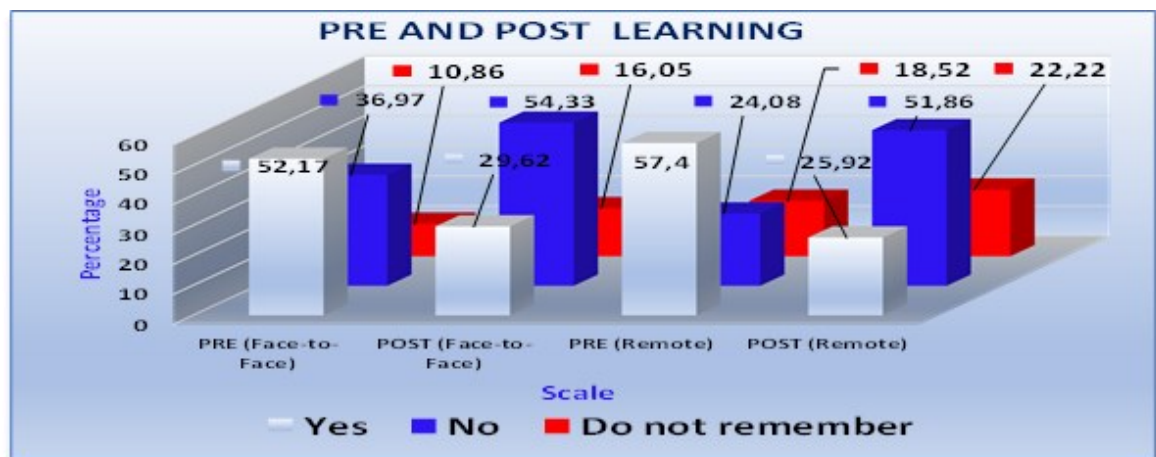
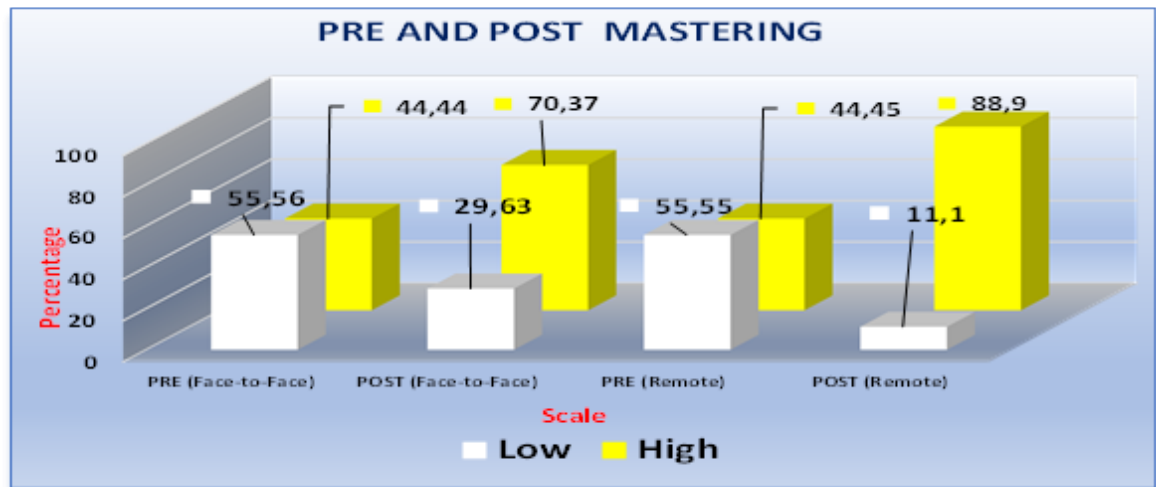
EF06CI07 - Sensorial and Motor Fisiology



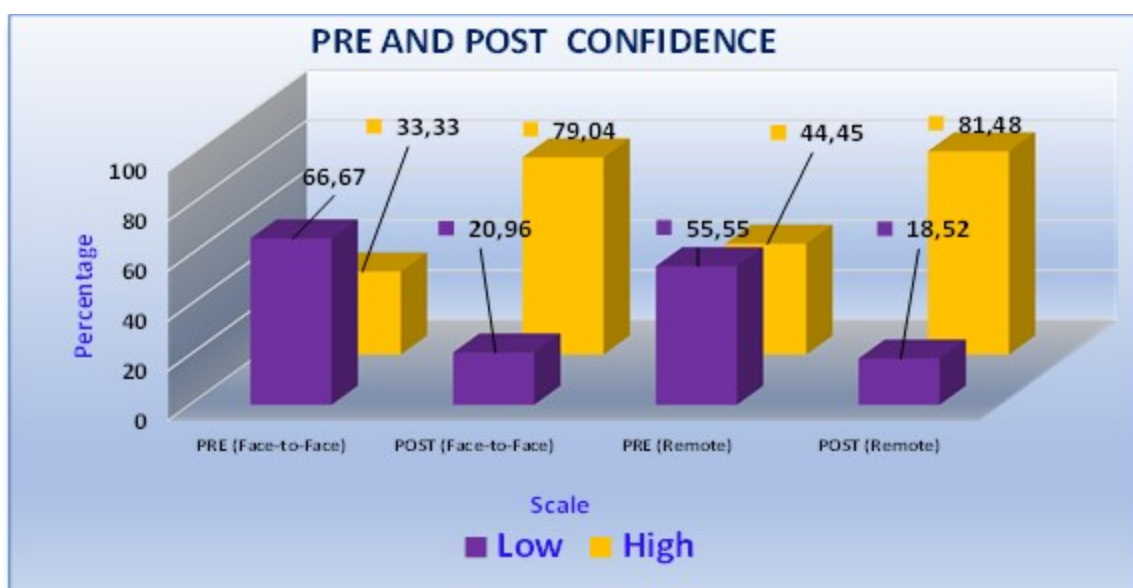
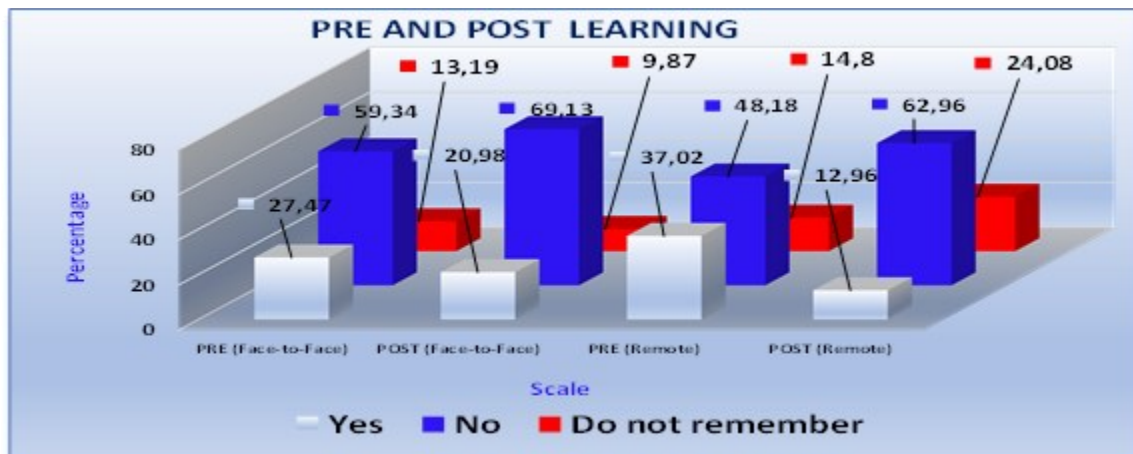
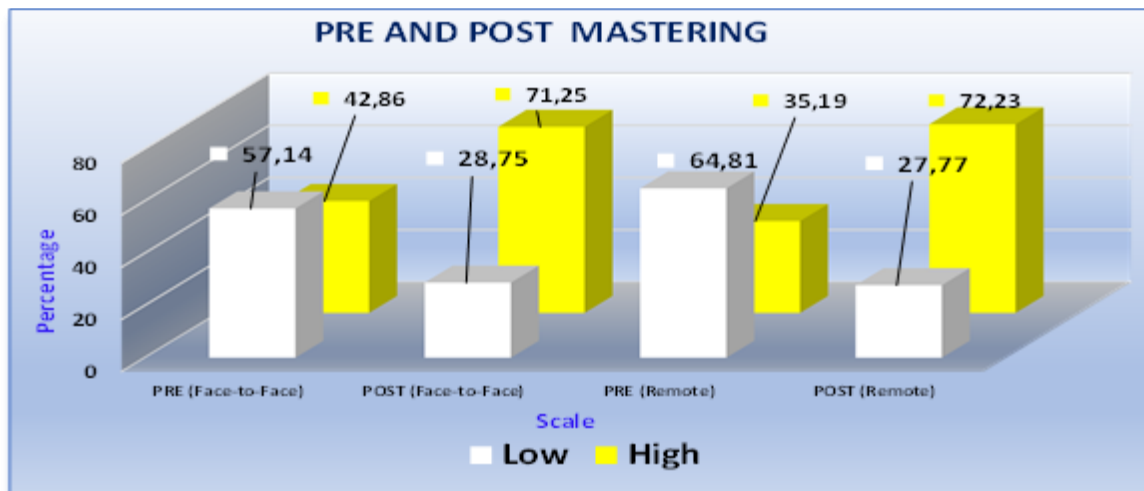
EF06CI08 - Vision and its Diseases



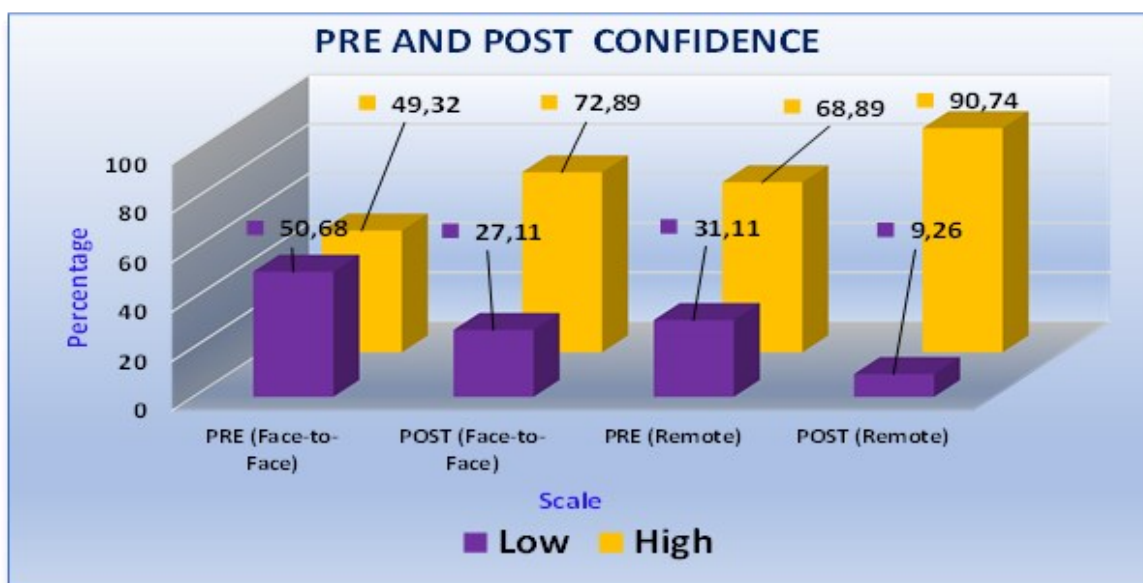
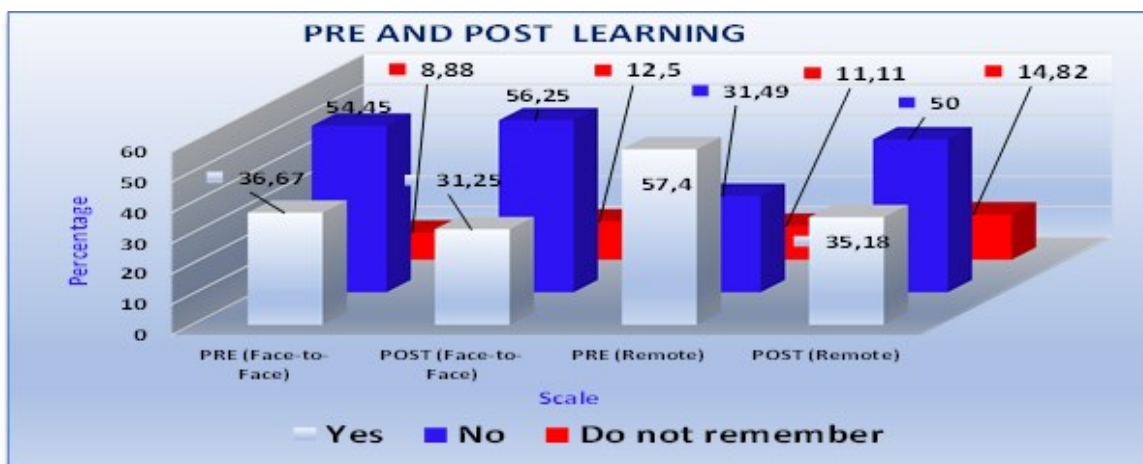
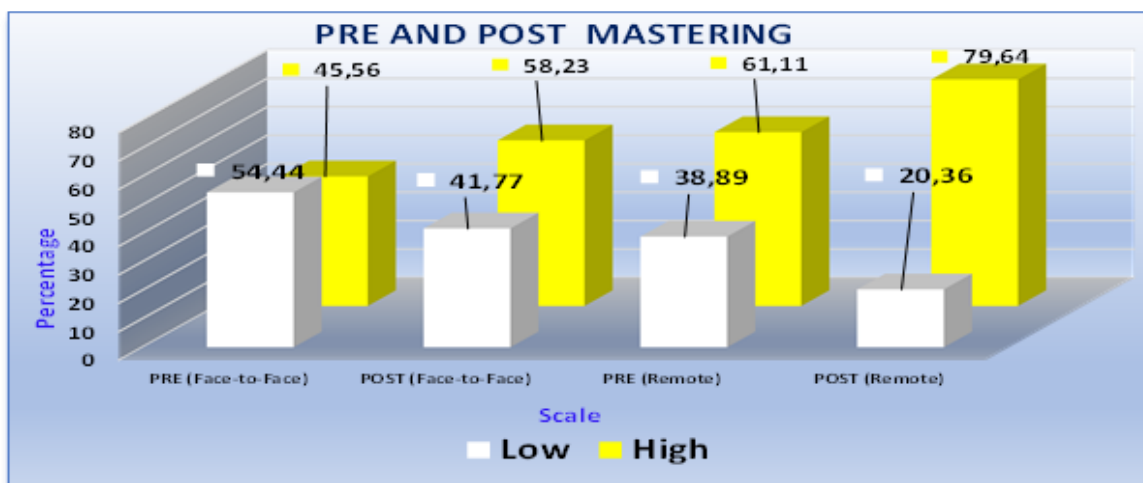
EF06CI09 - Locomotion Structures and Control



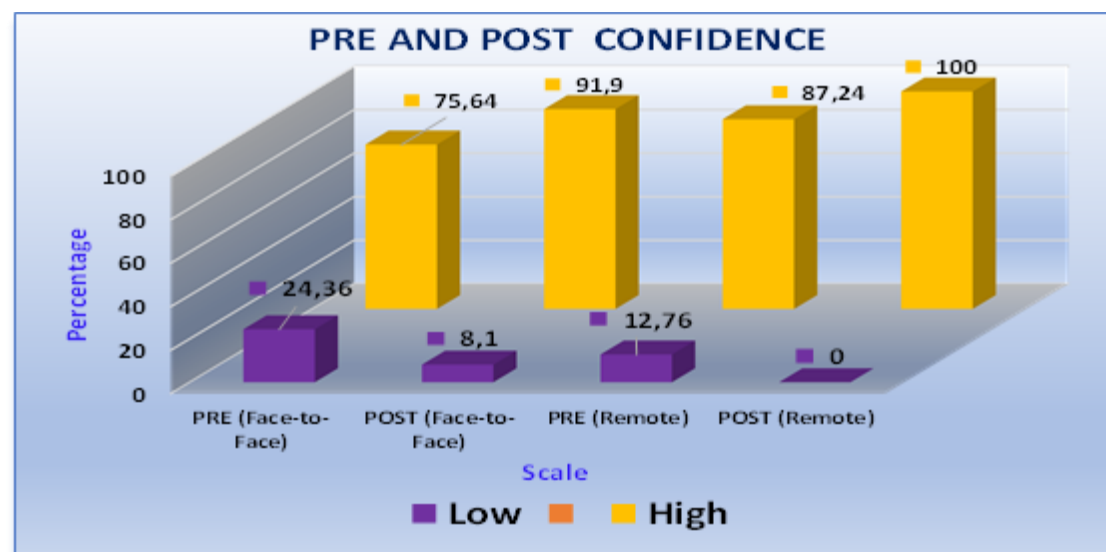
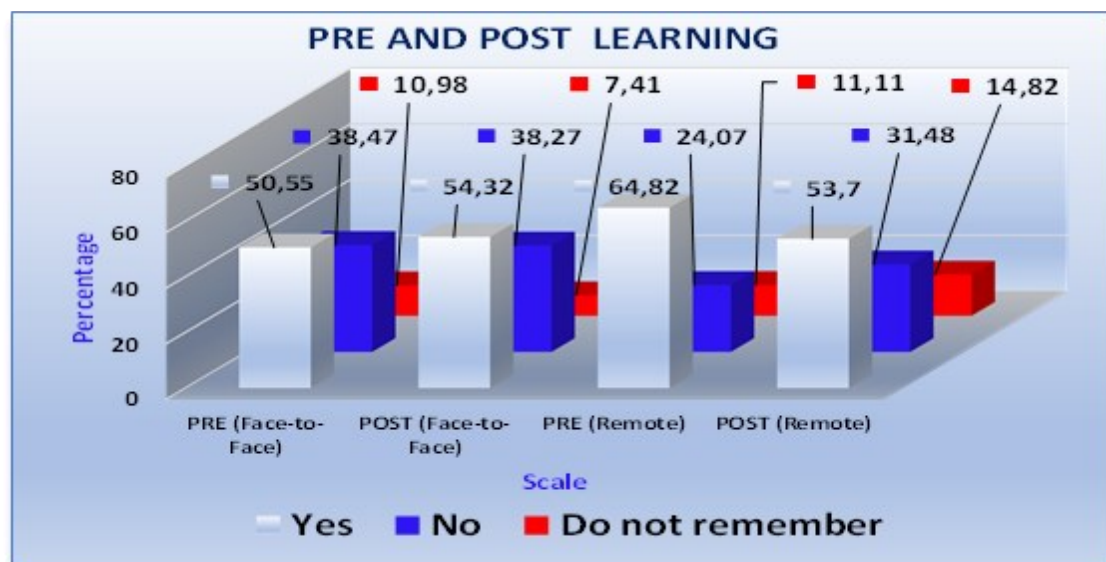
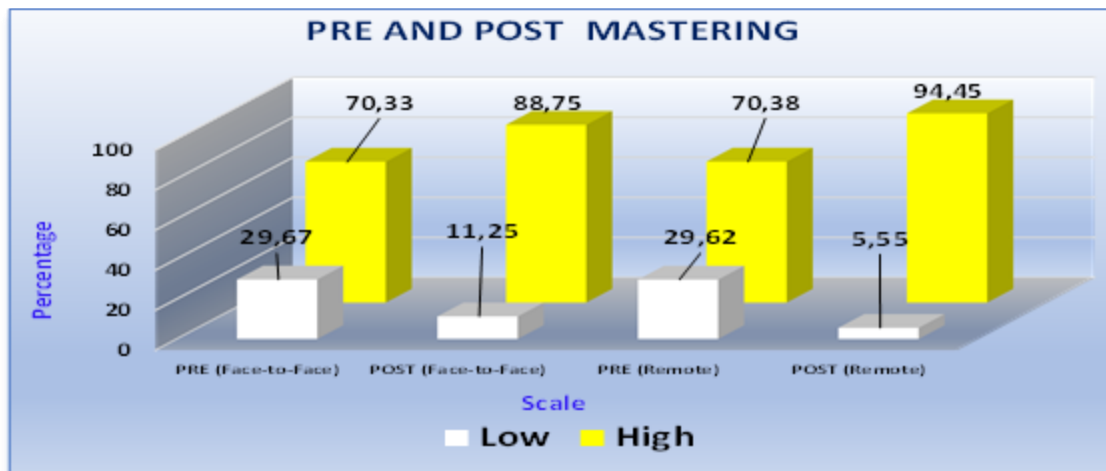
EF06CI10 - Nervous System and psychoactive substances



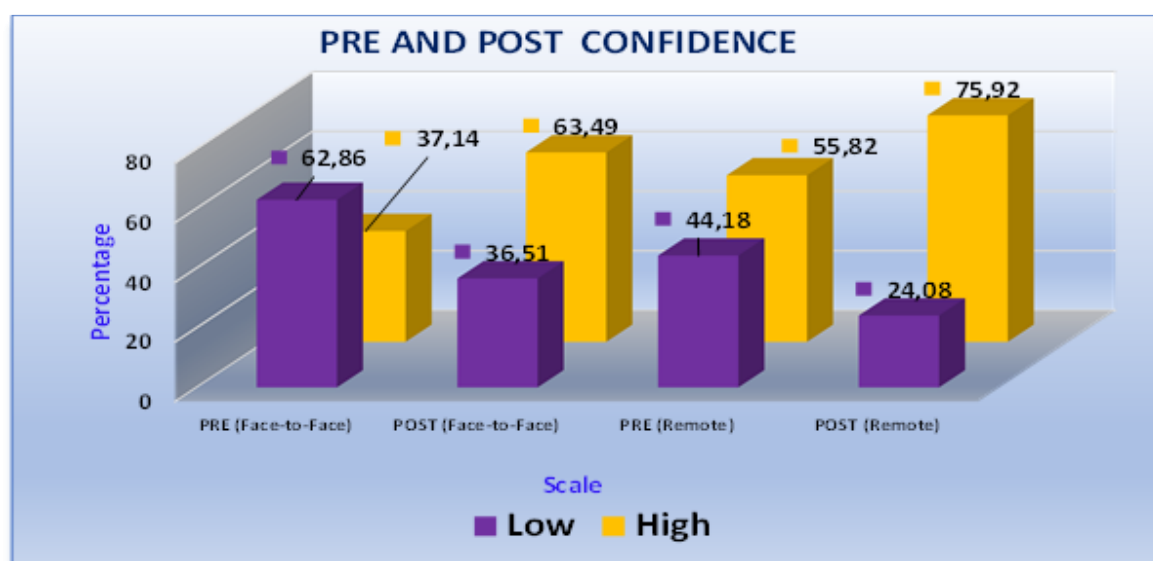
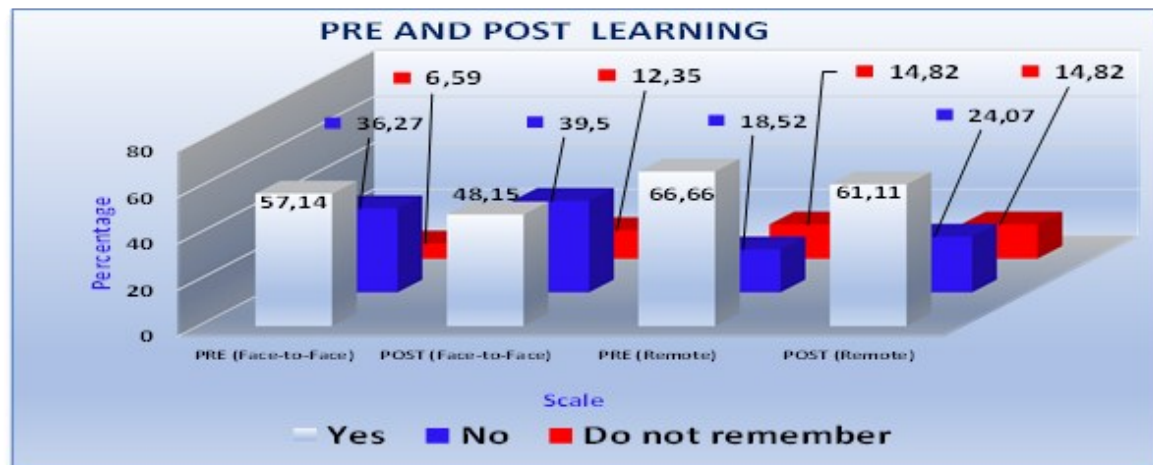
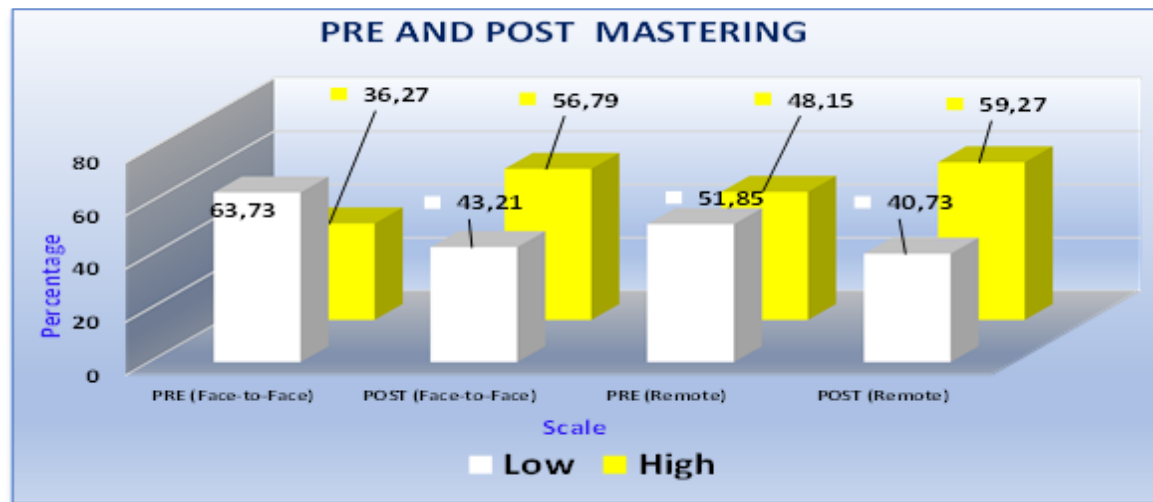
EF07CI09 - Public Policy Indicators for Health



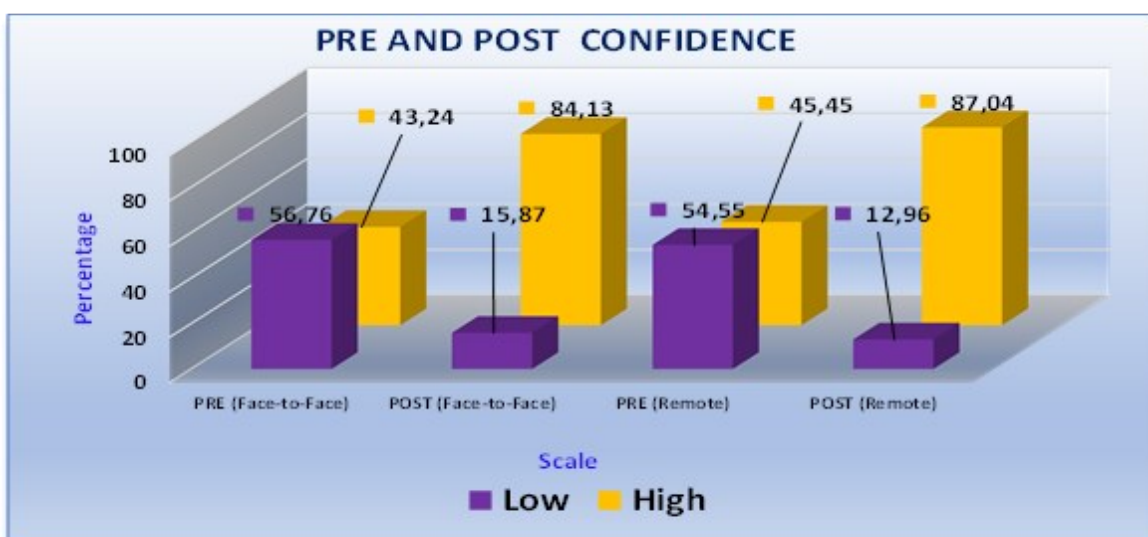
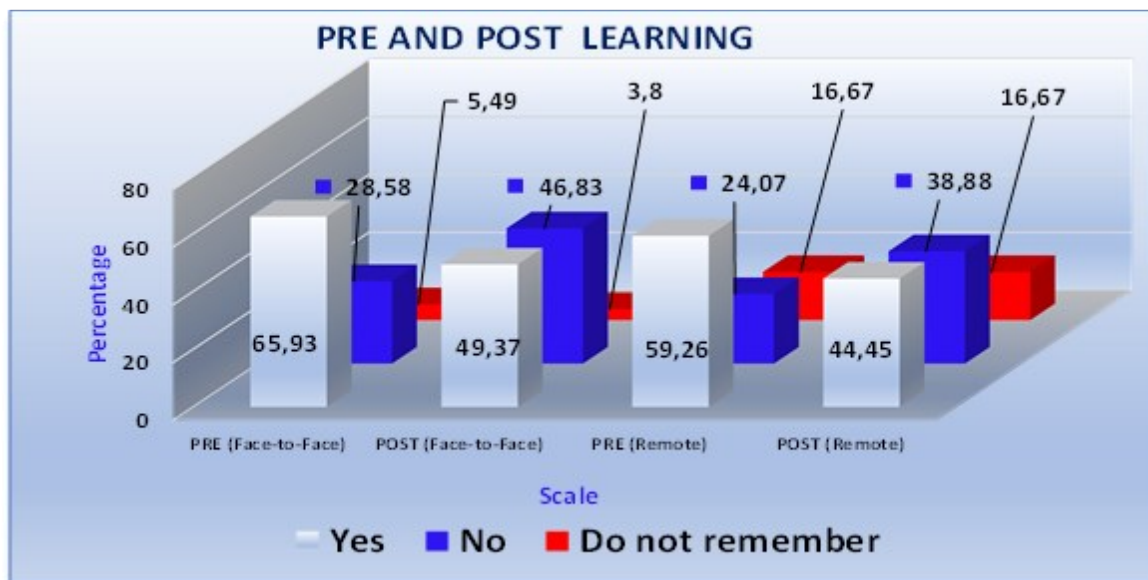
EF07CI10 - Vaccination



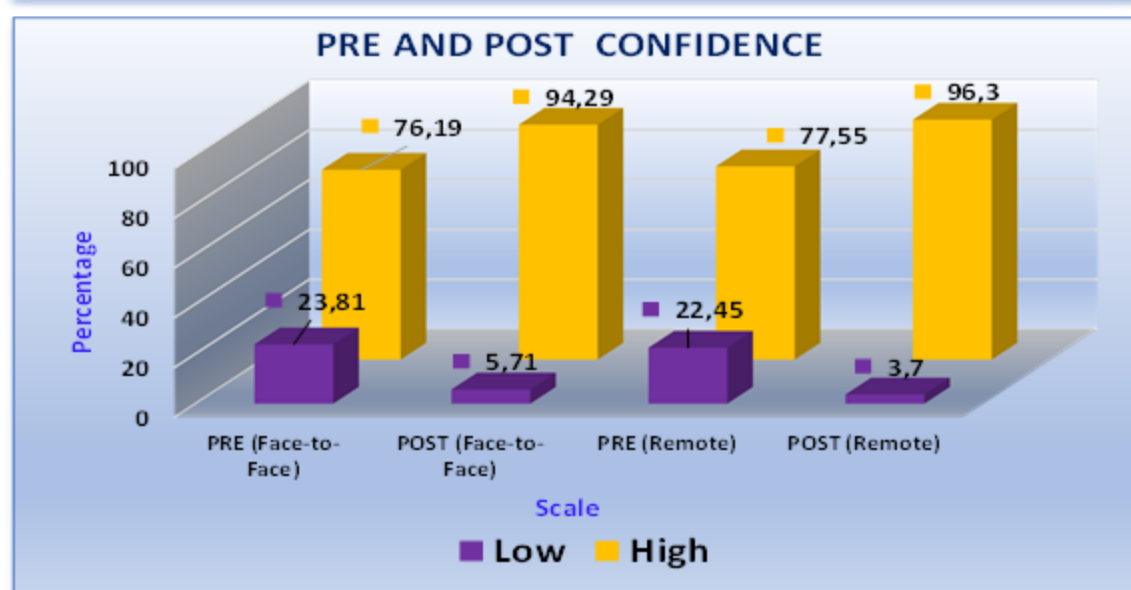
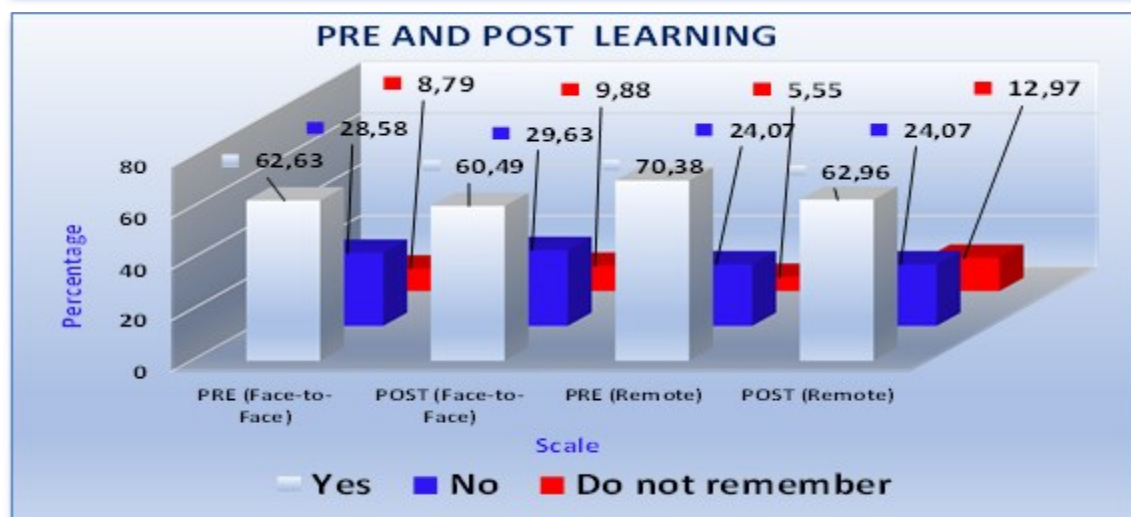
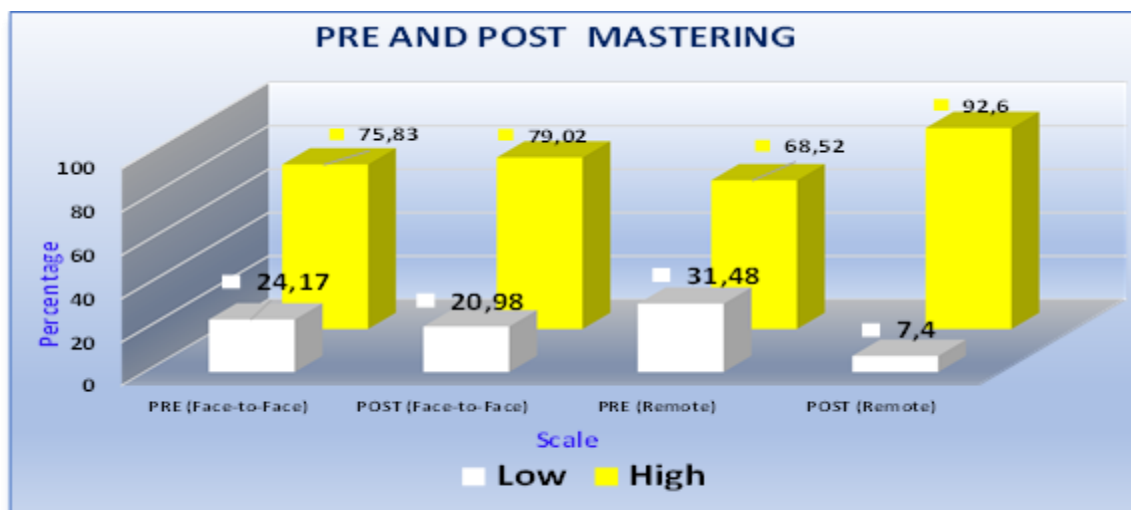
EF08CI07 - Evolution of Reproduction



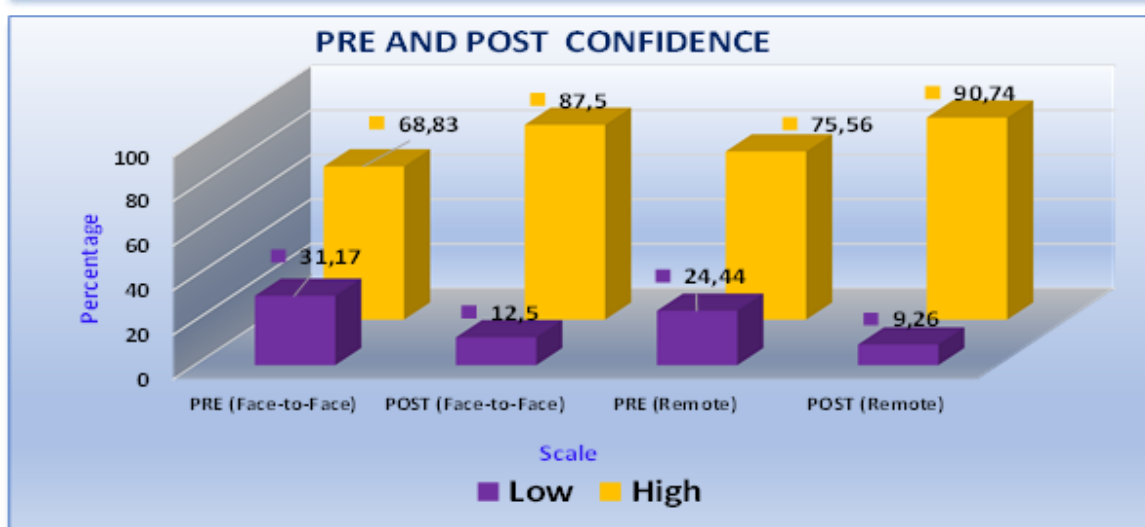
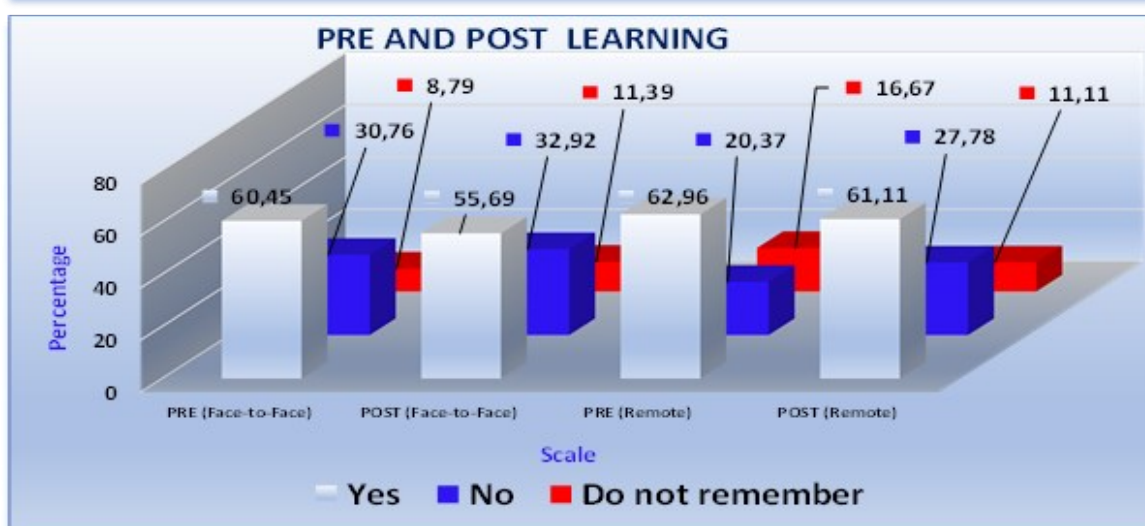
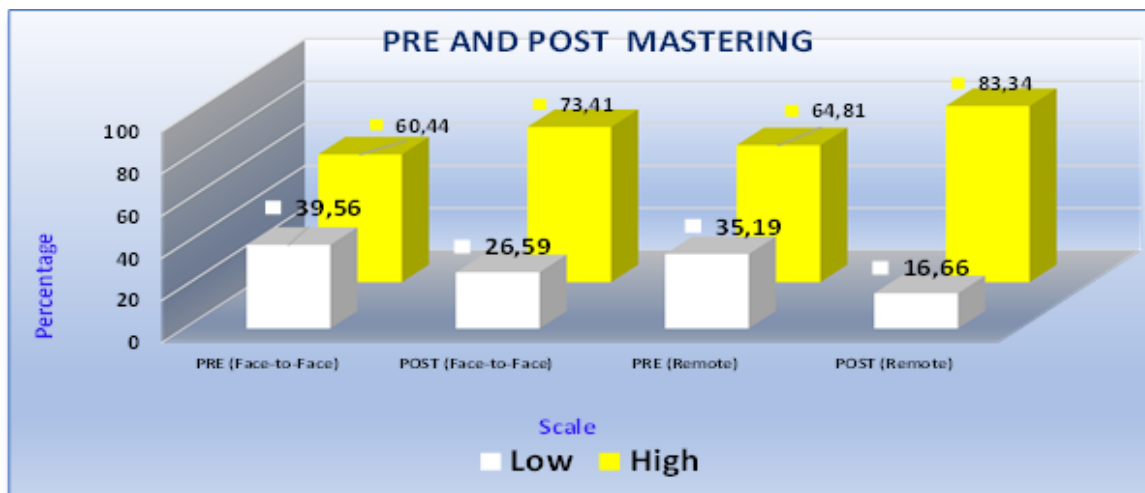
EF08CI08 - Puberty Transformations



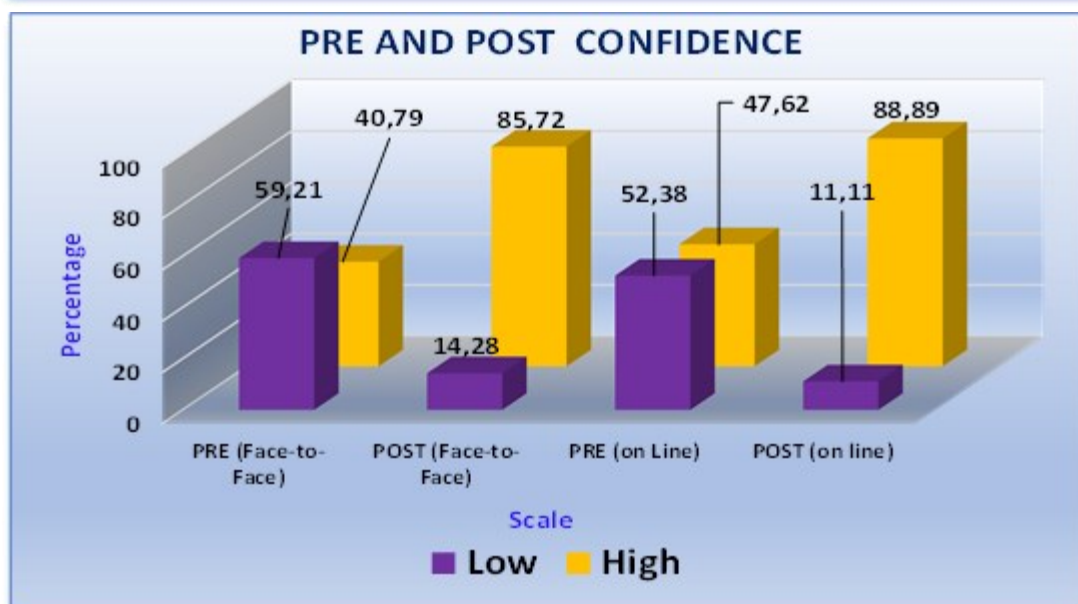
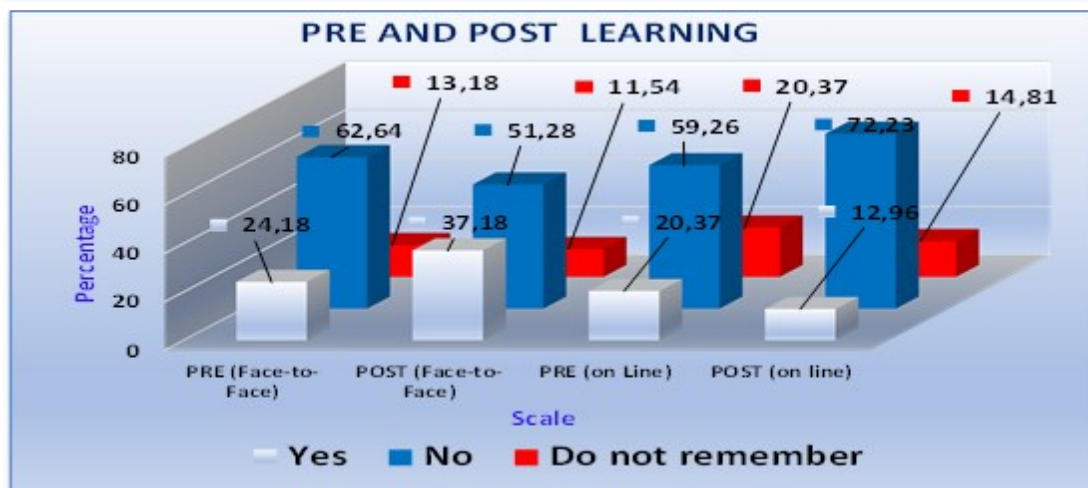
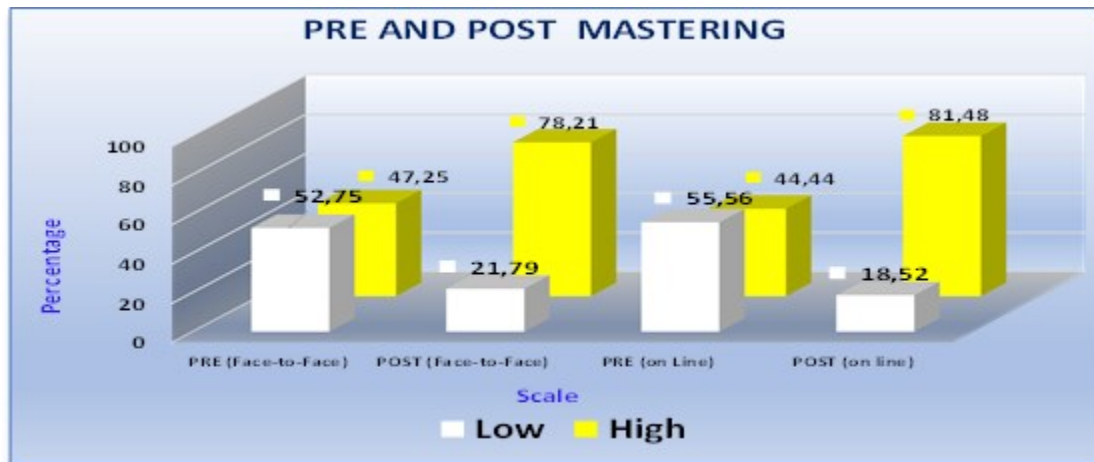
EF08CI09 - Contraceptives Methods



EF08CI10 - Sexually Transmitted Infections



EF08CI11 - Human Sexuality



9.3 UC CHEF - Corpo Humano: Estrutura e Função no formato ADE (2020)

Plano de ensino da UC Corpo Humano: Estrutura e Função no formato ADE

Unidade Curricular: Corpo Humano: Estrutura e Função	
Professor responsável/Depto.: Camilo de Lellis Santos (Dep. Ciências Biológicas)	
Contato (e-mail): lellis.camilo@unifesp.br	
Professor(es) colaborador(es)/Depto.: Nilana Tenório de Barros (Dep. Ciências Biológicas) Ligia Ajaime Azzalis (Dep. Ciências Exatas e da Terra)	
Ano letivo: 2020	Termo: 2
UC (fixa ou eletiva): fixa	
Pré-requisito (s): Não há	
Carga horária total (horas): 72	
Ementa Fundamentos da anatomia, histologia e fisiologia do corpo humano. Terminologias anatômicas. Homeostase. Eletrofisiologia celular. Tecidos fundamentais. Características morfofisiológicas do sistema locomotor. Características morfofisiológicas do sistema nervoso. Características morfofisiológicas do sistema endócrino. Características morfofisiológicas do sistema cardiovascular. Características morfofisiológicas do sistema respiratório. Características morfofisiológicas do sistema digestório. Características morfofisiológicas do sistema urinário. Características morfofisiológicas dos sistemas reprodutores. Estratégias de ensino sobre o corpo humano.	

Objetivos**Geral**

Compreender como a organização estrutural das células e tecidos contribuem para os processos fisiológicos do corpo humano e integram os fenômenos de homeostasia.

Habilidades e Competências

Conhecimento da organização estrutural e funcional dos sistemas biológicos do corpo humano.

Desenvolvimento do raciocínio crítico e cognição para argumentar sobre o impacto das variáveis físicas e químicas e determinantes psicossociais no estado estável do corpo humano.

Consolidação dos conceitos científicos acerca da anatomia, histologia e fisiologia do corpo humano.

Desenvolvimento da criatividade para aplicação e criação de práticas didáticas sobre o corpo humano.

CRONOGRAMA E PLANEJAMENTO CONCEITUAL

SEMANA	CONTEÚDO GERAL	CONTEÚDO ASSÍNCRONO (VÍDEO-AULAS)	CONTEÚDO SÍNCRONO	CH
1ª Sem. 18-21/11 <i>Curadoria:</i> Camilo	Introdução à UC Fundamentos da Homeostasia	Tutorial do funcionamento da UC Questionários de levantamento de conhecimentos prévios.	Aula Homeostasia	4
2ª Sem. 23-28/11 <i>Curadoria:</i> Camilo	Introdução aos estudos em morfologia. Histologia dos Tecidos Fundamentais	Técnica de coloração HE Tecido Epitelial Tecido Conjuntivo Tecido Muscular Tecido Nervoso Quiz-Portifólio Intro. à Histologia REENSINA	<i>Retrieval practice</i> Planos e cortes anatômicos Prática de histologia: lâmina do intestino e pata de rato. Início do Mapa Conceitual COVID-19	5

3ª Sem. 30/11-05/12 Curadoria: Camilo	Bioeletrogênese	Transporte através da membrana Potencial de membrana Potencial de ação Quiz-Portifólio Bioeletrogênese REENSINA	<i>Retrieval practice</i> Prática simulador de potencial de membrana Início do projeto Investigando a Fisiologia Humana	5
4ª Sem. 07-12/12 Curadoria: Camilo	Neurofisiologia	Anatomia do Sistema Nervoso Histologia do SNC Fisiologia da Sinapse Quiz-Portifólio Neurofisiologia REENSINA	<i>Retrieval practice</i> Jogo Integração Neuronal Lâmina do Cerebelo	5
5ª Sem. 14-19/12 Curadoria: Camilo	Fisiologia Sensorial e Motora	Fisiologia Sensorial Sistemas Motores Quiz-Portifólio Fisiologia Sensorial e Motora REENSINA	<i>Retrieval practice</i> Prática fisiologia sensorial com um familiar (áreas funcionais do córtex, arco-reflexo, campo receptor e adaptação sensorial)	5
6ª Sem. 21-22/12 Curadoria: Camilo	Avaliação de meio do termo	Prova II via Moodle	NÃO HAVERÁ ENCONTRO SÍNCRONO Perguntas & respostas sobre o projeto Investigando a Fisiologia Humana será via fórum ou whatsapp	3
7ª Sem. 04-09/01 Curadoria: Camilo	Crescimento e Motricidade Humana	Anatomia e histologia óssea Crescimento e remodelamento ósseo Histologia Muscular Contração Muscular Quiz-Portifólio Motricidade Humana	<i>Retrieval practice</i> Prática morfologia óssea Vídeoaula Quiz-Portifólio Emissão do parecer do projeto	5

		REENSINA	Investigando a Fisiologia Humana	
8ª Sem. 11-16/01 Curadoria: Nilana	Sistema Respiratório	Vídeoaula Razões e reações no sistema respiratório em condições fisiológicas Efeitos do Sars-Cov2 no sistema respiratório humano Quiz-Portfólio	Desenvolvimento 1 do Mapa Conceitual COVID-19 Desbravando centros científicos de informação na temática	5
9ª Sem. 18-23/01 Curadoria: Nilana	Fisiologia Gastrointestinal	Vídeoaula Alimentando a vida Compreendendo os mecanismos do corpo para transformar e sobreviver.. Quiz-Portifólio	Prática digestão enzimática Desbravando centros científicos de informação na temática	5
10ª Sem. 25-30/01 Curadoria: Lígia	Sangue, um tecido integrador	Vídeoaula/Leitura de texto Componentes sanguíneos e suas funções. Hemostasia. Quiz-Portifólio Prática histologia do tecido sanguíneo	Desenvolvimento 2 do Mapa Conceitual COVID-19	5
11ª Sem. 01-06/02 Curadoria: Camilo	Fisiologia Cardiovascular	Anatomia e histologia cardiovascular Atividade elétrica no coração Pressão Arterial Prática a dança do ritmo cardíaco Quiz-Portifólio Cardiovascular REENSINA	<i>Retrieval practice</i> Práticas aprendizagem baseada em artes Lâmina artéria vs veia	5
12ª Sem. 08-13/02 Curadoria: Camilo	Fisiologia Endócrina	Mecanismos de ação hormonal Eixo Hipotálamo-Hipófise-Glândula Quiz-Portifólio Fisiologia Endócrina	<i>Retrieval practice</i> Prática hormônio vs glândula	5

		REENSINA	Desenvolvimento do projeto Investigando a Fisiologia Humana	
13ª Sem. 15-20/02 <i>Curadoria:</i> Camilo	Integração Neuroendócrina	Integração neuroendócrina Capítulo livro fisiologia da tireóide Quiz-Portifólio ritmos biológicos REENSINA	<i>Retrieval practice</i> Prática o caso dos hormônios tireoidianos	5
14ª Sem. 22-27/02 <i>Curadoria:</i> Camilo	Fisiologia da Reprodução	Sistema Reprodutor Masculino Sistema Reprodutor Feminino Quiz-Portifólio Sistemas reprodutores REENSINA	<i>Retrieval practice</i> Fisiologia do ato sexual Prática Jogo dos sexos	5
15ª Sem. 01-03/03 <i>Curadoria:</i> Camilo Lígia	Sistema Urinário. Avaliação somativa Final	Videoaula/Leitura de texto Sistema Urinário: componentes e suas funções na formação da urina e no controle da pressão arterial Prova Final via Moodle	Revisão e Encerramento da UC Conclusão do mapa conceitual COVID-19	5

AVALIAÇÃO

Avaliação formativa – 60 pontos

Por meio da metodologia de aprendizagem baseada em projeto, os alunos deverão executar um projeto de investigação de variáveis fisiológicas coletadas por smartphones ou instrumentos caseiros de detecção de variáveis (por exemplo: termômetro), sendo os experimentos com smartphones aqueles que garantirão maior pontuação. O projeto final valerá 20 pontos. Esta avaliação será individual.

Por meio da metodologia da prática do recordar (*retrieval practice*), os alunos responderão aos Quiz-Portifólios de modo assíncrono referentes às vídeo-aulas disponibilizadas previamente. A nota final para os Quiz-Portifólios será de 20 pontos, onde a pontuação do aluno será igual ao número de perguntas dos Quiz-Portifólios respondidos corretamente dividido pelo número total de perguntas dos Quiz-Portifólios da UC. Esta avaliação será individual.

O mapa conceitual do será entregue em 4 etapas: inicial, intermediária I, intermediária II e final. E será avaliada a capacidade dos membros do grupo em agregar conceitos aprendidos nas aulas

ao mapa conceitual que abordará a temática central: COVID-19. Esta avaliação será em grupo contendo no mínimo 3 e no máximo 5 membros.

Avaliação somativa – 15 pontos

Por meio de prova clássica disponibilizada previamente e com prazo de 48 horas para responder, os alunos serão testados quanto aos conhecimentos conceituais aprendidos na UC. Serão 3 provas valendo 5 pontos cada.

Avaliação de engajamento – 25 pontos

Por meio dos dados de conclusão de atividades, os alunos serão avaliados quanto ao engajamento na execução das atividades propostas pelo professor. Dentre as atividades haverá o REENSINA, onde o aluno deverá indicar num formulário os dois conteúdos que mais teve dúvidas sobre o material das atividades assíncronas disponibilizadas para a semana. A pontuação final do aluno será igual ao número de atividades concluídas dividido pelo número total de atividades disponibilizadas. A pontuação máxima a ser obtida será de 25 pontos.

Para satisfazer o critério “cumprido” o aluno deverá obter pontuação final igual ou superior a 60 pontos na somatória final dos pontos obtidos na avaliação formativa, avaliação somativa e avaliação de engajamento.

HORÁRIOS DAS ATIVIDADES SÍNCRONAS

Turma A: Quinta-feira das 15:30h às 17:30h

Turma B: Quarta-feira das 15:30h às 17:30h

Turma C: Quinta-feira das 20:00h às 22:00h

Turma D: Quarta-feira das 20:00h às 22:00h

METODOLOGIA DE ENSINO

- As atividades síncronas ocorrerão majoritariamente via Zoom ou eventualmente pelo Google Meet (links disponibilizados no Moodle)
- As práticas de metodologias de aprendizagem ativa serão realizadas utilizando-se os softwares/aplicativos: *Socrative* para *peer instruction* e *cMap tools* para mapas conceituais.
- As aulas práticas de histologia serão realizadas por meio de laminários virtuais disponíveis em: <https://cps.med.ubc.ca/virtual-histology/> e <http://www.histologyguide.com/index.html>
- As aulas práticas de fisiologia serão realizadas utilizando a metodologia dos MobLeLabs (Laboratórios de Aprendizagem Móvel) de acordo com: LELLIS-SANTOS, CAMILO & ABDULKADER, FERNANDO. Smartphone-assisted experimentation as a didactic strategy to maintain practical lessons in remote education:

physiology education during the COVID-19 pandemic. *Advances in Physiology Education*, 21: 579-586, 2020.

ATENDIMENTO DE MONITORES E ESTAGIÁRIOS DO PROGRAMA DE APERFEIÇOAMENTO DIDÁTICO (PAD)

	Quarta-Feira	Quinta-Feira
Tarde	Turma B Julia Ferreira Aianne Souto Kaio Macedo Luana Maciel	Turma A Julia Ferreira Kaio Macedo Thaís Santos
Noite	Turma D Julia Ferreira Taysa Bassani Emanuel Almeida Luana Maciel Thaís Santos	Turma C Julia Ferreira Gilberto Paiva Anderson K. Ueno Luana Maciel Thaís Santos Sandro Tonin

BIBLIOGRAFIAS BÁSICA E COMPLEMENTAR

As referências indicadas com (e-book) estão disponíveis gratuitamente pela biblioteca da Unifesp para uso durante o ensino remoto.

Bibliografia básica

TORTORA, G.J.; DERRICKSON, B. Princípios de Anatomia e Fisiologia. 14ª. Ed. Rio de Janeiro: Guanabara Koogan, 2016. (e-book)
 ROSS, M.H.; PAWLINA, W. Ross Histologia texto e atlas. Correlações com biologia celular e molecular. 7ª. Ed. Rio de Janeiro: Guanabara Koogan, 2016. (e-book)
 KOEPPEN, B. M.; LEVY, B.M.; BERNE, M.N. Berne & Levy: Fisiologia. 7ª Ed. Rio de Janeiro: Elsevier, 2018. (e-book)

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 DANGELO, J.G.; FATTINI, C.A. Anatomia Humana. Sistemica e Tegumentar. 3ª. Edição. São Paulo: Atheneu, 2007.

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 ARTNER, L.P.; HIATT, J.L. Atlas colorido de histologia. 4ª edição. Rio de Janeiro: Guanabara Koogan, 2007.
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 JUNQUEIRA, L.C.U.; CARNEIRO, J. Histologia Básica - Texto e Atlas. 13ª edição, Editora Guanabara Koogan, 2017. (e-book)
 SOBOTTA, J. Atlas de anatomia humana. 23ª edição. Rio de Janeiro: Guanabara Koogan, 2013. (e-book)

10 ANEXO - UNIFESP - ETHICS COMMITTEE**PARECER CONSUBSTANCIADO DO CEP****DADOS DO PROJETO DE PESQUISA**

Título da Pesquisa: O CONHECIMENTO PRÉVIO DOS ALUNOS DA FORMAÇÃO DE PROFESSORES DE CIÊNCIAS E MATEMÁTICA SOBRE OS CONTEÚDOS DO CORPO HUMANO APRESENTADOS NA BASE CURRICULAR NACIONAL COMUM.

Pesquisador: Gilberto de Paiva Dias

Área Temática:

Versão: 1

CAAE: 31106920.5.0000.5505

Instituição Proponente: UNIVERSIDADE FEDERAL DE SAO PAULO

Patrocinador Principal: UNIVERSIDADE FEDERAL DE SAO PAULO

DADOS DO PARECER

Número do Parecer: 4.070.490

Apresentação do Projeto:

Projeto CEP/UNIFESP n: 0440/2020 (parecer final)

Trata-se de projeto de Mestrado

Orientador: Prof. Dr. Camilo de Lellis Santos

Equipe de Pesquisa: Gilberto de Paiva Dias

Projeto vinculado ao Departamento de Ciências Biológicas, Campus Diadema, Instituto de Ciências Ambientais, Químicas e Farmacêuticas, UNIFESP

