



Educational Article

Exploration of the changes in the perceptions of medical students about cadaver dissections using metaphors

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المخلص

أهداف البحث: هذه الدراسة تحقق في التغييرات في التعبيرات المستخدمة من قبل طلاب الطب قبل وبعد تشريح الجثث. مما سيساعد على فهم نوعي لمعنى تشريح الجثث.

طرق البحث: تم جمع التعبيرات المجازية حول ممارسة التشريح قبل وبعد تمارين التشريح من 147 طالب طب كوري. وقد تم تصنيف البيانات النوعية المجمعة من خلال التحليل المقارن المتكرر.

النتائج: حددت نتائج التحليل سبعة أنواع من التعبيرات المستخدمة قبل ممارسة التشريح: "طقوس المرور"، و"الخطوة الأولى"، و"الفرصة الثمينة"، و"الضباب"، و"الجحيم"، و"الإثارة"، و"السيف ذو الحدين". بعد تشريح الجثث، تم استخدام تسعة أنواع من التعبيرات: "التأمل"، و"الجحيم"، و"الفرصة الثمينة"، و"البحث عن الكنز"، و"نقطة تحول"، و"الدبون"، و"الضباب"، و"الحلوى المرّة"، و"ضارب الجرس". بشكل عام، قبل تشريح الجثث، أدرك الطلاب أهمية ممارسة تشريح الجثث كـ "بوابة" أو "ألم النمو". ظهرت تعابير مثل "التأمل" و"المرأة" في الممارسة العملية، إلى جانب تحسن في موقفهم. ومع ذلك، لا يزال بعض الطلاب يستخدمون تعابير سلبية، مثل "الجحيم" قبل وبعد تشريح الجثث وحافظوا على مشاعر سلبية حول تشريح الجثث.

الاستنتاجات: تشير نتائج دراستنا إلى أن تشريح الجثث بالنسبة للعديد من طلاب الطب هو مرحلة حاسمة للتأمل الذاتي وتكوين هويتهم كطبيب. إن النظر في تصورات الطلاب في تشريح الجثث أمر ضروري.

الكلمات المفتاحية: تعابير؛ طالب طب؛ تشريح الجثث؛ تصور الطالب؛ التغييرات المجازية

Abstract

Objective: This study examines the changes in metaphors used by medical students before and after the dissection of a cadaver. This will help qualitatively understand the meaning of cadaver dissections.

Methods: The metaphorical expressions about the practice of dissection that were used before and after the dissection exercises were collected from 147 Korean medical students. The collected qualitative data were categorised through a repeated comparative analysis.

Results: The results of the analysis identified seven types of metaphors that were used before the dissection practice: 'rite of passage', 'first step', 'precious opportunity', 'fog', 'hell', 'thrill', and 'double-edged sword'. After the cadaver dissection, nine types of metaphors were used: 'introspection', 'hell', 'precious opportunity', 'treasure hunt', 'turning point', 'debt', 'mist', 'bittersweet candy', and 'buzzer beater'. In general, before a cadaver dissection, students recognised the importance of the practice of cadaver dissection as being a 'gateway' or a 'growing pain'. Metaphors such as 'introspection' and 'mirror' were used with an improved attitude. However, some students continued to use negative metaphors, such as 'hell', before and after the cadaver dissection and maintained negative feelings about it.

Conclusions: The results of our study suggest that, for many medical students, cadaver dissection is a crucial stage of self-reflection and for the formation of their identities as doctors. The consideration of students'

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perceptions during all cadaver dissections is therefore essential.

Keywords: Cadaver dissection; Medical student; Metaphor; Metaphoric changes; Student perception

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Typically, the first gateway of a medical student's entry into medical school is anatomy, and this reality first hits them when they encounter cadaver dissection.¹ Medical students' experience of anatomy and cadaver dissection is a significant transition from being a nonprofessional to becoming a specialist. Cadaver dissections are the starting point from which medical professionalism begins to develop for those students who will become physicians.^{2–4}

Since the Renaissance, dissecting cadavers is the most reliable method of teaching anatomy.⁵ It is a more vivid process of learning, by touching and observing actual human structures directly, using the theory of anatomy.^{5,6} This stage of learning is an important process that is fundamental to medicine.

In addition to gaining practical knowledge about the human body, the cadaver dissection also includes physical and emotional dimensions. Medical students often experience physical reactions, such as headaches, dizziness, nausea, and negative emotional reactions, such as anxiety, guilt, and post-traumatic stress syndrome.^{6–14} The first cadaver dissection experience is an important event that induces special cognitive, physical, and emotional responses for many medical students. Most students adapt appropriately to this situation through experience.¹⁵ The emotional responses and self-reflections that are experienced during this adaptation process play an important role in shaping their professional identities.^{16–19} Therefore, the medical community has tried to investigate the emotional responses of students as they affect the students' future doctor-patient relationships.^{20,21}

Although previous studies have provided important information on medical students' thoughts and feelings about cadaver dissection, most of those studies used an empirical approach. In other words, their ability to grasp the phenomenon of the experience was limited in a variety of ways. To improve the effectiveness of cadaver dissection education in medical school, we cannot focus only on socio-statistical methods to analyse student responses. Rather, we need a deeper understanding of the complex emotions that occur between the cadaver and the student, and how their perceptions change before and after the cadaver dissection experience.

As a way of understanding how students understand and perceive their experiences, this study attempted to analyse the perception of cadaver dissections through their use of metaphors, which are often not studied in the field of medical education. Metaphors have a broad influence on all areas of human language, thoughts, and actions. Metaphors that are imaginative, creative, and outside the conventional system of concepts become a new way to understand someone's

experiences.²² It is also a measure of how to understand phenomena that reflect sociocultural myths, and a way to gain insight into the nature of objects.^{23–25}

A metaphor is also a cognitive action that structurally connects thought and action. It therefore provides a framework for interpreting people's experiences and gives meaning to those experiences.²⁶ A metaphor is a way of conceptualising or thinking about an experience that gives the student an overall conceptual system of how to think about a particular concept, what to experience, and how to act, based on that concept, in everyday life. Therefore, metaphorical analysis can direct educational treatment according to different perceptions of cadaver dissection by providing individual or specific group thinking and behavioural patterns.²⁷ It can be an alternative way to explore the complex perceptions that medical students have about cadaver dissections with more depth than previous quantitative studies.

This study explored medical school students' perceptions of a cadaver dissection before and after the dissection practice and the changes in their perceptions through an analysis of the metaphors they used, with the aim to provide basic data needed for the development of teaching methods involving cadaver dissection. The research questions of this study were as follows.

- 1) What were the metaphors that medical students used to describe their experience of cadaver dissection before and after the dissection was performed?
- 2) What were the changes to individual metaphors and perceptions that were caused by the cadaver dissection?

Materials and Methods

Participants

The participants in this study included 147 first-year medical school students in southern Korea. The anatomical cadaver dissection course was selected as the subject of study as it is a mandatory course for first-year medical students. The researcher responsible for collecting and investigating the data was one of the researchers who worked at the medical school but had no direct connection with the students. The class was taught by an anatomy professor who was not a collaborator in this study. Therefore, there was no conflict of interest between students and researchers involved in the study. The investigator explained to the students the purpose and content of the study before the dissection. They were informed that they would not be harmed before and during the investigation, and that they may refuse to participate at any time if they did not wish to do so. A total of 95 male students and 52 female students (total 147 participants) participated before the start of the cadaver dissection, and 89 male students and 52 female students participated after cadaver dissection, with voluntary consent. It was a non-invasive, self-reporting method that was independent of sensitive personal information (sexual orientation, medical information, etc.), which revealed the student's own perceptions through two open, paper-based questions. The study was conducted after the researchers had obtained

approval from the institutional review board of the institution to which they belonged. If the students provided a metaphor that had a negative perception after cadaver dissection, the medical school provided an opportunity for future professional counselling.

Data collection

To collect data for this study, medical students were asked to write down a metaphor describing the cadaver dissection and explain why they chose that metaphor. The test tool consisted of two open questions. In the first question the student freely entered the word (OOO) in the sentence "To me, cadaver dissection is OOO". The second question asked the student to explain why they used such a metaphor to refer to their experience of the cadaver dissection. The answers to the two questions were retrieved in the same way as many previous studies that sought to understand perceptions of certain objects through metaphor.^{28–33} Finally, the metaphorical responses used by the study participants to express their experiences of the cadaver dissection were collected and analysed. The data were initially collected three days before the start of the cadaver dissection exercise, and were collected once again, using the same questions, on the day after the cadaver dissection exercise.

Data analysis

Collected textual data were analysed through a repeated comparative content analysis by three researchers. This process was executed by repeatedly examining each datum and categorising it based on common points and differences between it and the other data. The focus of the data analysis was on the metaphors used. During the categorical coding process, researchers consecutively reviewed the texts containing metaphorical expressions and reason statements, and

then reviewed the data by comparing the two texts. In cases where the content in the students' responses were ambiguous, interviews were conducted with those students to clarify the meanings of the metaphors they used. In addition, a number of member-checking consultations were conducted with external experts through major medical institutions and professors of medical schools. The interrater reliability between two raters was acceptable given that Cohen's Kappa was 0.71 ($p < 0.01$). For the examination of gender differences in metaphor representation on cadaver dissection, a cross tabulation test with χ^2 test was conducted with SPSS statistics 21.

After categorising the metaphors, a network analysis was conducted to visualise the change in perception of all the students after the dissection practice. In this study, it was assumed that a network is a set of nodes representing each metaphor category, and that the networks are links between two nodes that represent students' change in perceptions before and after a cadaver dissection. For the network analysis the software NetMiner ver 4.0 (Cyram, Seongnam, Korea) was used.

Results

Metaphors used before the experience of cadaver dissection

The results of the analysis identified seven types of metaphors used before the dissection practice: 'rite of passage', 'first step', 'precious opportunity', 'fog', 'hell', 'thrill', and 'double-edged sword'. The number and percentage of metaphors used before the cadaver dissection are shown in Table 1. Cross-tabulation with the χ^2 test revealed no significant relationships between gender and membership in any category of metaphor ($\chi^2 = 9.176$, $p > 0.05$). Each metaphor will be described in more detail below.

Table 1: Number and percentage of metaphors used before the cadaver dissection.

| | Metaphors and synonyms used by the participants | Number of participants | % |
|---|--|--------------------------------------|-------------------------|
| 1 | 'Rite of passage': (Gateway, growing pain, a steep cliff, and a mountain to climb) | Male: 18 Female: 15 Total: 33 | 12.2% 10.2% 22.4% |
| 2 | 'First step': (Starting line, foundation stone, and navigation) | Male: 21 Female: 10 Total: 31 | 14.3% 6.8% 21.1% |
| 3 | 'Precious opportunity': (Glory, gift, and jewel) | Male: 17 Female: 12 Total: 29 | 11.6% 8.2% 19.7% |
| 4 | 'Hell': (pain, bungee jump, single log bridge, marathon) | Male: 17 Female: 3 Total: 20 | 11.6% 2.0% 13.6% |
| 5 | 'Fog': (labyrinth, escape from a desert island, military, Latin) | Male: 6 Female: 7 Total: 13 | 4.1% 4.8% 8.8% |
| 6 | 'Thrill': (a gift underneath a Christmas tree, new semester, dream of winning the lottery, delicious meal) | Male: 9 Female: 2 Total: 11 | 6.1% 1.4% 7.5% |
| 7 | 'Double-edged sword': (field trip, rose, Pandora's box, Ural Mountains) | Male: 7 Female: 3 Total: 10 | 4.8% 2.0% 6.8% |
| | Total | Male: 95 Female: 52 Total: 147 | 64.6% 35.4% 100% |

Table 2: Number and percentage of metaphors used after the cadaver dissection.

| | Metaphors and synonyms used by the participants | Number of participants | % |
|----|--|--------------------------------------|------------------------|
| 1 | 'Introspection': (mirror, album, letter of apology) | Male: 19 Female: 11 Total: 30 | 13.5% 7.8% 21.3% |
| 2 | 'Treasure hunt': (ocean, 2,000-piece puzzle, light) | Male: 15 Female: 9 Total: 24 | 10.6% 6.4% 17.0% |
| 3 | 'Precious opportunity': (treasure, gemstone, assets) | Male: 15 Female: 8 Total: 23 | 10.6% 5.7% 16.3% |
| 4. | 'Hell': (nightmare, marathon, Monday, typhoon) | Male: 14 Female: 8 Total: 22 | 9.9% 5.7% 15.6% |
| 5 | 'Debt': (resentment, sacrifice, funeral, guilt, gratitude) | Male: 4 Female: 8 Total: 12 | 2.8% 5.7% 8.5% |
| 6 | 'Turning point': (awakening, portal, bud, growing pain) | Male: 7 Female: 3 Total: 10 | 5.0% 2.1% 7.1% |
| 7 | 'Bittersweet candy': (acupressure mat, morning, exam, bitter medicine) | Male: 7 Female: 2 Total: 9 | 5.0% 1.4% 6.4% |
| 8 | 'Fog': (difficult puzzle, inference or deduction) | Male: 4 Female: 3 Total: 7 | 2.8% 2.1% 5.0% |
| 9 | 'Buzzer beater': (buzzer beater, refreshing) | Male: 4 Female: 0 Total: 4 | 2.8% 0% 2.8% |
| | Total | Male: 89 Female: 52 Total: 141 | 63.1% 36.9% 100% |

Cadaver dissection is a rite of passage

Before the cadaver dissection, the most common metaphor used by 33 students (22.4%) to describe the cadaver dissection included words associated with a rite of passage, such as 'gateway', 'growing pain', 'a steep cliff', and 'a mountain to climb'. These metaphorical expressions suggest that students regard the cadaver dissection as a task they need to perform regardless of the great efforts required. However, at the same time, they felt a sense of responsibility. Examples are presented below.

A gateway that must be gone through to become a doctor. [Participant A2 - Presented the 'gateway' metaphor]

That's what I'll have to overcome one day. [Participant A3 - Presented the 'steep cliff' metaphor]

It will be tough and difficult, but it is something I must go through and do well in order to grow up. [Participant A6 - Presented the 'growing pain' metaphor]

Cadaver dissection is the first step to becoming a doctor

Thirty-one students (21.1%) described the cadaver dissection as the 'first step', implying that it is the first step to becoming a doctor. Similar metaphors were 'starting line',

'foundation stone', and 'navigation'. These metaphors suggest that students recognise the importance of cadaver dissection as a foundation of medicine. They also believe that the experiences of cadaver dissection will be crucial to the academic process and to their development as medical practitioners.

First step as a medical practitioner. [Participant B1 - Presented the 'starting line' metaphor]

Cadaver dissection is an excellent guide for studying medicine throughout one's career. [Participant B10 - Presented the 'navigation' metaphor]

Anatomy is the foundation of medicine. [Participant B11 - Presented the 'foundation stone' metaphor]

Cadaver dissection is a precious opportunity

Thirty students (20.4%) submitted metaphors that communicated the idea that the cadaver dissection was a 'precious opportunity', and regarded the experience as a great opportunity for the students. Other words submitted were 'glory', 'gift', and 'jewel'. These metaphors represent the idea that a cadaver dissection is a special experience that is allowed only for a limited number of people. Consequently, the students regarded the cadaver dissection as an

opportunity, like a precious gift for which they should be grateful. They therefore used metaphors expressing such gratitude, especially to the donors who made the opportunity possible. Examples are presented below.

An act of generosity that donors have given for my development. [Participant C1 - Presented the 'gift' metaphor]

This is the first and last chance to study and practice dissection of the human body. [Participant C2 - Presented the 'precious opportunity' metaphor]

A priceless and generously provided experience that only a select few can have. [Participant C16 - Presented the 'glory' metaphor]

Cadaver dissection is a fog

Among the responses, 13 students (8.8%) used metaphors relating to a 'fog', referring to the uncertainty and ambiguity of a cadaver dissection. These metaphors reflect the frustration and ambiguity regarding the unfamiliarity with the class and how it will proceed. Students also used metaphors such as 'labyrinth', 'military service', and 'escape from a desert island' to express such uncertainty and ambiguity. Examples are presented below.

Because I cannot see an inch ahead due to the physiological and psychological burden. [Participant D1 - Presented the 'fog' metaphor]

Because it is an unknown world, and only the people who have joined the army can explain the army. [Participant D5 - Presented the 'military service' metaphor]

Because I cannot find a way out. [Participant D8 - Presented the 'labyrinth' metaphor]

Cadaver dissection is hell

Twenty students (13.6%) recognised the difficulty of performing a dissection and expressed their mental burden and fears regarding cadaver dissection by describing it as 'hell'. These types of metaphors included 'pain' and 'bungee jumps', which reflect their low confidence and concerns

about their ability to withstand the heavy burden of a cadaver dissection. Typical examples are presented below.

I am afraid my rhinitis is so severe that I will not be able to breathe and that it will be too scary to be in the room. [Participant E2 - Presented the 'hell' metaphor]

Because I am afraid and too weak to stand it. [Participant E9 - Presented the 'pain' metaphor]

I am afraid because I have never experienced it before. [Participant E12 - Presented the 'bungee jump' metaphor]

Cadaver dissection is a thrill

Ten students (6.8%) expressed having positive expectations for cadaver dissection. Regarding it as a new experience, the students metaphorically described the practice by recalling positive experiences they had previously felt, such as 'a gift underneath a Christmas tree', a 'dream of winning the lottery', a 'new semester', a 'challenge', and as 'heart pounding' to express their strong expectations of cadaver dissection. Examples are presented below.

Because it is the subject that I looked forward to the most when I came to medical school. [Participant F1- Presented the 'gift underneath a Christmas tree' metaphor]

Because I am so looking forward to it. [Participant F11 - Presented the 'dream of winning the lottery' metaphor]

Cadaver dissection is a double-edged sword

Ten students (6.8%) expressed a viewpoint that was a mix of curiosity and fear. They used the metaphor of a 'double-edged sword'. Terms such as the 'double-edged sword' and the 'rose' were used to express curiosity and fear about the difficulties of cadaver dissection while anticipating its positive aspects. Examples are presented below.

Although I am excited to practice and understand the human body accurately, I am also afraid that the atmosphere will be scary and very heavy. [Participant G4 - Presented the 'double-edged sword' metaphor]

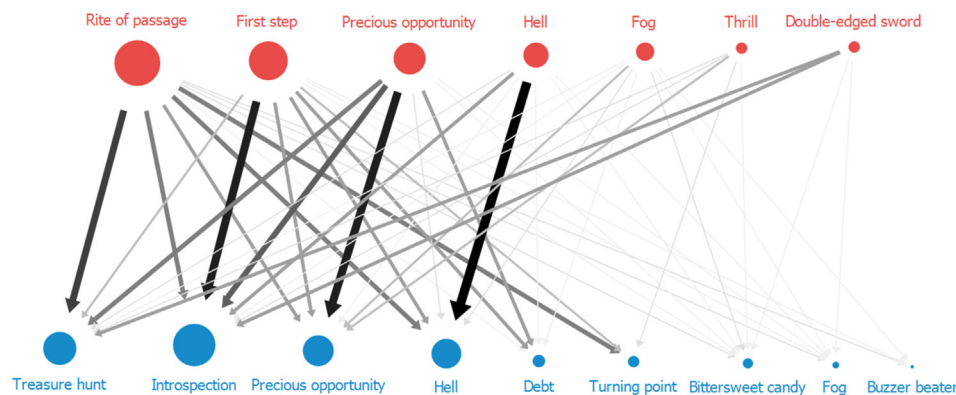


Figure 1: Network graph representing changes in metaphors before and after cadaver dissection.

It looks cool, but I think it will be exhausting. [Participant G5 - Presented the 'rose' metaphor]

Metaphors used after the experience of cadaver dissection

After the cadaver dissection, nine types of metaphors were used: 'introspection', 'hell', 'a precious opportunity', 'treasure hunt', 'turning point', 'debt', 'mist', 'bittersweet candy', and 'buzzer beater'. The number and percentage of metaphors used after the cadaver dissection are shown in Table 2. Cross-tabulation with the χ^2 test revealed no significant relationships between gender and membership in any category of metaphor ($\chi^2 = 8.103$, $p > 0.05$). Each metaphor will be described in more detail below.

Cadaver dissection is introspection

The terms most commonly used by students to describe the cadaver dissection after their experience was the metaphor type, 'introspection'. Thirty students (21.3%) used metaphors such as 'mirror' and 'album' in reference to the way that dissection allowed them to look at themselves. In addition, some students expressed regret and reflected on their laziness during the cadaver dissection, using a metaphor such as 'letter of apology'. The following are representative examples of responses from students who used this type of metaphor.

I had a chance to reflect on myself every week during and after the dissection. [Participant C19 - Presented the 'mirror' metaphor]

The dissection gave me many thoughts and made me look back at myself. [Participant F7 - Presented the 'album' metaphor]

I get to reflect on myself every time I come into the room because I seem to have neglected studying anatomy. [Participant B10 - Presented the 'letter of apology' metaphor]

Cadaver dissection is a treasure hunt

Twenty-four students (17.0%) described the experience of cadaver dissection positively, using metaphors such as 'treasure hunt', 'ocean', '2,000-piece puzzle', and 'light'. These metaphors imply that the cadaver dissection is a mysterious process of exploring the human body, which is an unknown domain. As a process of exploration, the cadaver dissection was satisfactory to students. It helped them learn about the human body, which initially felt unfamiliar and complicated at the beginning, and widened their perspectives. Examples are presented below.

At first, I could not identify a thing and did not know how to explore, but now that I am used to dissection, I feel joy when I find structures and name them properly. [Participant A15 - Presented the 'treasure hunt' metaphor]

Exploring the human body is like exploring the ocean. At first, it is shallow and easy to swim, but as one goes deeper,

it becomes more mysterious. [Participant A14 - Presented the 'ocean' metaphor]

I had no idea what to do and how to do it, but I was able to see the woods at the end with knowledge I gathered during the dissection. [Participant G5 - Presented the '2,000-piece puzzle' metaphor]

Cadaver dissection is a precious opportunity

Cadaver dissection was regarded as a valuable opportunity by 23 students (16.3%). This type of metaphor was exemplified by terms such as 'travel', 'treasure', and 'gemstone'. These metaphors reveal a positive attitude towards the many learning experiences that students underwent during the cadaver dissection. Examples are presented below.

I realised that it was a precious responsibility after the ritual. [Participant C17 - Presented the 'water' metaphor]

It is a valuable experience that allowed us to have first-hand experience and actually understand what was written in the textbook. [Participant E11 - Presented the 'treasure' metaphor]

Cadaver dissection is hell

Twenty-two students (15.6%) used 'hell'-type metaphors to express their negative feelings about cadaver dissection after the experience. They expressed the mental and physical suffering experienced during the cadaver dissection by using terms such as 'nightmare' and 'marathon'. The weekly repetition of the practice made it a difficult thing to adapt to. The amount of learning, the mental shock, and other reasons caused great pain. Examples are presented below.

It is so exhausting, and I am constantly in pain. [Participant A9 - Presented the 'hell' metaphor]

I am afraid to start, and it wears me down even when it is over. [Participant E2 - Presented the 'nightmare' metaphor]

No matter how hard I try, I cannot see the end. [Participant E13 - Presented the 'marathon' metaphor]

Cadaver dissection is a debt

After the cadaver dissection, 12 students (8.5%) used metaphorical terms such as 'liabilities', 'debt', 'emotional burden', and the 'sacrifice of others' to express their sense of gratitude and appreciation to the donor. Examples are presented below.

Now that it is over, I have many regrets, and I feel sorry and grateful to the donor. [Participant A6 - Presented the 'emotional burden' metaphor]

I think I am indebted to the donor because I was able to dissect the human body and learn through the donor's

precious body. Therefore, I must be a good doctor and pay it back. [Participant B5 - Presented the 'liabilities' metaphor]

Even though the dissection is over, there are still many things that I do not know. Therefore, we always have to say sorry to the donor. [Participant D5 - Presented the 'debt' metaphor]

Cadaver dissection is a turning point

After the experience of cadaver dissection, 10 students (7.1%) described their dissection practice as a turning point in their lives. In this metaphor, cadaver dissection is seen as changing the students' views about the dignity of life, their attitudes towards medical learning, or the direction of their activities as a medical student. This type of metaphor included the ideas of a 'turning point', an 'awakening', or a 'portal'. Examples are presented below.

I thought I should study more seriously. [Participant A1 - Presented the 'turning point' metaphor]

It has served as a gateway to the mysteries of the human body, the realisation of human dignity, empirical knowledge, and a new relationship with teammates. [Participant A11 - Presented the 'portal' metaphor]

Cadaver dissection is a bittersweet candy

Nine students (6.4%) used the metaphor of 'bittersweet candy' to describe the cadaver dissection, referring to the coexistence of positive and negative aspects. Such metaphors included references to the 'morning'. Examples are presented below.

It was exhausting and the smell was hard to stand. It was especially difficult to find the structure of the human body compared to the textbook. On the other hand, I think it will be more memorable since I was actually able to find what I have read about in the book by cooperating with my teammates. [Participant C22 - Presented the 'bittersweet candy' metaphor]

Dissection is a precious experience, like the beginning of the beautiful day. However, I still feel tired and want to stay in the bed for a little longer. [Participant E17 - Presented the 'morning' metaphor]

Cadaver dissection is a fog

There were seven students (5.0%) who still felt uncertainty and ambiguity after the cadaver dissection and used 'fog'-type metaphors. They used metaphorical terms such as 'drama' and 'difficult puzzles' to express their regret over the fact that there were many things they did not clearly understand even after the cadaver dissection. The following are representative examples of responses from students using this type of metaphor.

It is still unclear even after the dissection is almost over. [Participant D7 - Presented the 'fog' metaphor]

Uncertain about what will happen and such a shame that the ending has already happened. [Participant D1 - Presented the 'drama' metaphor]

Cadaver dissection is a buzzer beater

After finishing the cadaver dissection practice, there were also four students (2.8%) who expressed their comfort with the difficult cadaver dissection by using metaphors such as 'buzzer beater' and 'refreshing'. These metaphors commonly express relief and imply that while studying anatomy was a difficult task, the students were able to withstand it. The following are representative examples of responses from students using this type of metaphor.

That is because I made it through to the end. [Participant A19 - Presented the 'buzzer beater' metaphor]

It is because I feel relieved that I am almost finished. [Participant B22 - Presented the 'refreshing' metaphor]

Exploration of metaphoric 'changes' through individual tracking

Figure 1 shows the network graph representing the change of metaphors used by students before and after the cadaver dissection. In the network graph, each dot represents each metaphor and the colours of the dots represent the period of data collection. Red marks the time before and blue marks the time after the cadaver dissection. The lines drawn between the red and blue dots represent each student's change in metaphor type between cadaver dissection experiences. The size of each dot correlates to the frequency of each type of metaphor. The width and darkness of the lines correlate to the number of students who have shown a change between two types of metaphor.

As the network graph shows, there were diverse types of changes between metaphors. There were a total of 49 different links between the types of metaphors. Among the 49 links in the graphs, the darkest and widest link was the link from 'Hell' to 'Hell', which showed the changes in metaphors of nine students. The second darkest and widest links were the two links from 'Precious opportunity' to 'Precious opportunity' and from 'First step' to 'Introspection', which shows the changes in metaphors of eight students. This result implies that a considerable number of students tend to maintain their initial image on cadaver dissection even after the dissection experience.

For a more in-depth understanding of students' change of metaphors, we attempted to analyse qualitatively how medical school students expressed their perception of cadaver dissection through the use of metaphors, by focusing on the cases of some characteristic individuals. Four cases focused on in this study are described as follows.

The case of research participant A2 (from gateway to gemstone)

Among the medical school students who participated in the study, A2 presented 'gemstone' as a metaphor for anatomical practice, after having presented 'gateway' before the experience. A2 used the metaphor 'gateway' as many medical students think of anatomical practice as a symbolic course of the medical school curriculum. However, A2 revealed that their perception had changed as they used the metaphor, 'gemstone', for the cadaver dissection after the experience. Although not a negative metaphor, 'gateway' implies that the dissection is an essential and mandatory experience that one must go through. This perception is formed not only by the mass media, but also by seniors, juniors, and major professors once a student has enrolled into medical school. Like general medical students, A2, recognised the importance of the cadaver dissection practice, and conceptualised and expressed their perception using the 'gemstone' metaphor after the actual experience. This meant that their perception changed as the vagueness of A2's cadaver dissection was resolved. One reason given by A2 for why they used the 'gemstone' metaphor was that it reminded them that 'the harder you work, the more you can learn, but if you don't, you won't get anything'.

The case of research participant E2 (from hell to nightmare)

Participant E2 used the word 'hell' before experiencing the cadaver dissection, and 'nightmare' after as metaphors for the dissection. The metaphor of 'hell' was a result of the many stories about cadaver dissection that students had heard from their seniors. E2 had considerable fears about the curriculum before the practice of cadaver dissection. E2's response showed that they were unable to breathe comfortably before and during the class because of their severe rhinitis. They also thought that they would suffer from the odours caused by the disinfectants and bodies in the laboratory. This negative metaphor persisted even after the dissection exercise. After experiencing the anatomical dissection practice, E2 presented a metaphor conceptualising the perception of anatomical practice using the word 'nightmare'. The reason they used this metaphor was because they were scared at the beginning and found that in the end, the cadaver dissection was very indeed mentally and physically difficult. Out of the entire curriculum, the student began the cadaver dissection with a fear that it may be a 'nightmare'. It was conceptualised in their memory as a hellish and intense experience. Under these circumstances, knowledge acquisition during the course of the cadaver dissection may not have been achieved well. This intensely conceptualised experience could become a metaphor for life, affecting later choices in one's speciality or other career choices.

The case of research participant C16 (from luck to gold)

Among the medical school students who participated in the study, C16 mentioned 'luck' as a metaphor for the cadaver dissection before the experience, and presented 'gold' as a metaphor for anatomical practice after the experience. The reason that participant C16 used the metaphor of

good luck for cadaver dissection was that a cadaver dissection can only be experienced by medical students. C16's explanation of 'a valuable and thankful experience that no one else can do' enabled us to grasp C16's perception, which focused on the importance and scarcity of opportunities for cadaver dissection. Although it seemed similar to A2's 'gateway' metaphor in terms of its recognition of the importance of anatomy and cadaver dissection, C16's metaphor was more intense, obligatory, and grateful. A student who conceptualised cadaver dissection perceptions using such a metaphor would not feel ambivalent about the curriculum. After actually experiencing cadaver dissection, C16 revealed their awareness of cadaver dissection using the metaphor 'gold'. In the process, their metaphor changed, but their mentality of gratitude did not. In fact, after the cadaver dissection C16 responded, 'Because I actually saw the structure that I only viewed in a book, and with an appreciation of the donor's gift, it was more memorable and actually helped me a lot'. The contextual conceptualisation of the value of the educational experience itself and the appreciation of it provided a foundation for the knowledge gained for future learning, making the cadaver dissection a meaningful experience.

The case of research participant E9 (from pain to learning)

E9 used 'pain' as a metaphor for the anatomical practice before the experience, and used 'learning' as a metaphor after the experience. E9 used the 'pain' metaphor for the dissection prior to the experience as it was related to the characteristics of their personality. They were afraid that they would not be able to overcome the strong stimuli that are a part of the dissection as they had been weak in body and mind throughout childhood. There is no doubt that any student who comes to medical school is an excellent student in terms of academic achievement, but not all of them are bold students. Therefore, no matter how good the grades are, there can be many students who feel scared or weak. For these students, fear or anxiety about the experience of a cadaver dissection may be perceived as 'pain'. Fear or negative emotions caused by dissection interfere with the commitment to learning and have a significant impact. Such cases have been reported in biology classes, such as frog dissections during elementary and secondary school, as well as in veterinary and nursing classes. Surprisingly, however, E9 presented the 'learning' metaphor after the actual cadaver dissection, which was completely different from their previous metaphor of 'pain'. Although they were still afraid, they had conceptualised and recognised the importance of gaining authentic knowledge by actually experiencing it, which is hard to get from a book.

Discussion

In this study, the method of metaphor analysis was used to clearly identify ideas regarding the unique experience of a cadaver dissection. On the basis of these results, several characteristics were revealed.

First, the type of metaphor that appeared most frequently before the cadaver dissection was the (mandatory) 'rite of passage'. Metaphors such as 'gateway' presented by study

participant PS prior to the cadaver dissection, 'growing pain' by participant BJ, and 'a steep cliff' by participant SS, represent the recognition by medical students of the symbolic and ritualistic aspects^{34,35} for those licensed to study this course. Cadaver dissection is an important foundation for all future medical education, but can be concerning from a psychological perspective. However, while students experience an important starting point in their education during the cadaver dissection, they can also be overwhelmed by pressure before it even takes place. This may have a negative impact on later learning. Therefore, it is necessary to provide information about the anatomical practice before the cadaver dissection and to expose the students gradually through related videos.³⁶ Thus, positive attitudes towards learning are also important as they are closely related to learning outcomes.³⁷ Positive psychological experiences at the start and during the process of learning should also be important areas of interest to educators.

Second, before the start of the cadaver dissection, no metaphor was found to correspond to the reflective feelings about oneself that a cadaver dissection might induce, whereas it was the most commonly used metaphor category (28.4%) after the cadaver dissection took place. The students later regretted that they had not worked harder during the cadaver dissection. Research participants JN and MC used metaphors such as 'mirror' and 'album', among others, and reflected that the cadaver dissection was not limited to the time it took to memorise the detailed structure of the human body. These results show that medical practice students begin to form their identities as medical practitioners through the cadaver dissection. The results also show that cadaver dissection is a learning experience that has a very important effect on how medical students grow up to become doctors.

Third, after the end of the cadaver dissection, the metaphor related to negative emotions, namely, 'hell'-type metaphors, increased from 10.8%, before cadaver dissection, to 18.9% after. Many medical students experience a tremendous emotional impact or fear when confronted with a dead body, alongside the tremendous cognitive and emotional burden of memorising the many human structures with their colleagues over a short period of time. Consequently, many medical schools have an essential pre-dissection training programme. The main contents of this training comprise knowledge, techniques, and attitudes related to cadaver dissection and the psychological stability required at the beginning of cadaver dissection. After the cadaver dissection is over, there is a procedure for expressing respect and appreciation through a memorial service for the body donor. However, there are not many mental care courses for medical students who have participated in cadaver dissection. According to a previous study on students' experience of cadaver dissection, it was reported that 30% of students experience negative psychological reactions, such as 'depression' and 'anxiety', and 5% suffer from post-traumatic stress disorder,³⁸ indicating that mental care is needed after cadaver dissections.

After a cadaver dissection, students who still express a dark perspective through negative metaphors may have various problems over the long term. The negative metaphor formed shortly after cadaver dissection may affect the

student's choice of career or specialty as a physician. Such negativity can also extend to the whole of medicine and can impact whether a student's aptitude matches the profession of a doctor.¹ Medical students who use negative metaphors may experience a decline in the efficacy of their medical studies. Therefore, it is necessary to establish an extra curriculum for psychological stability after cadaver dissections and provide educational follow-up measures that provide professional counselling courses.

Fourth, medical students who participated in the study also presented positive metaphors. Cadaver dissection, of course, is a special experience with considerable impact. It is acknowledged that the experience is meaningful before the dissection, but after the dissection it is recognised that it is an opportunity granted to the person who receives this special medical curriculum. This is the case, for example, for the research participant MW who presented 'luck' (before) and 'gold' (after), as well as for JW who presented 'treasure hunt' (after), and CS, who presented 'buzzer beater' (after). For students who presented these metaphors, the cadaver dissection did not make them feel unafraid nor did they assume that it was easy. However, they realised how valuable the curriculum was to them despite the fact that it was rather difficult and painful. This change is very important, and the internalisation of the curriculum is confirmed by the change in the metaphor of students' perceptions. For example, this change is easy to find in the case of research participant SA who presented the 'pain' metaphor before the experience and the 'learning' metaphor after the experience.

Fifth, the uncertainty and ambiguity about cadaver dissections that were expressed by 'fog'-type metaphors were greatly reduced. Cadaver dissection improves learning effectiveness by using real bodies to apply the theoretical knowledge of anatomy in three dimensions, preparing students for clinical care by teaching them to control their eyes and hands. It provides students with the experience of emotional distractions as they face death for the first time.^{39,40} It is believed that uncertainty arises as students do not know in advance precisely how they will react or what they will have to do when dissecting an actual body or body part using their own eyes and hands. This suggests that it is necessary to organise and perform some form of pre-education before the start of cadaver dissection and to strengthen the connection between lecture and practice.

Sixth, some medical school students were found to use metaphors that express ambivalence both before and after cadaver dissection. Their ambivalence came from a mixture of two conflicting emotions, with differences before and after the start of the cadaver dissection. While there was a mixture of curiosity and fear before the start of the cadaver dissection, there was a mixture of suffering and gratitude after the dissection. People who suffer from ambivalence experience psychological pain, such as high levels of depression and anxiety, low subjective well-being, and many negative emotions exhibited in close relationships.⁴¹ Emotional changes result from experiencing fear and excitement when first entering the dissection lab^{8,11} and seeing their first dead body. However, these thoughts and feelings become significantly more positive after some time.⁴² Thus, the ambivalence expressed later is different from the one expressed before the experience of the dissection practice. It is necessary to support students through these changes

so that they can use them as opportunities to develop their understanding of human life and death.

Limitation of the study

The study has limitations in terms of generalisation as it examined only a small group of Korean students who took part in the cadaver dissection at medical school. Since the metaphors are usually formed and shared within a specific culture, the meaning of the same metaphor could be interpreted differently in other cultures. Therefore, the interpretation of metaphors in this study may be difficult to generalise to cultures other than Korean and East Asian cultures. In addition, since we did not follow up on the individual trends and tendencies of students in terms of pre- and post-dissection metaphors, it is difficult to see how deep their perceptual changes were. In-depth qualitative research to track the flow of more detailed observations or personal changes in a small number of students might permit more fruitful interpretations of medical school students' cadaver dissection experiences.

Conclusion

Based on the assumption that metaphors are an important tool for understanding experiences, this study attempted to grasp the meaning of medical students' first experience of cadaver dissection by analysing the metaphors they used. As a result of the study, it was found that the cadaver dissection was conceptualised through various meanings by students, as shown by the various types of metaphors that were used. The results of the analysis identified seven types of metaphors used before the dissection practice. After cadaver dissection, nine types of metaphors were used. In general, before cadaver dissection, students recognised the importance of the practice of cadaver dissection by representing it as a 'gateway' or 'growing pain'. Metaphors such as 'introspection' and 'mirror' appeared in practice, alongside an improved attitude. However, some students continued to use negative metaphors, such as 'hell', before and after cadaver dissection and maintained negative feelings about it. Based on the results of this study, we suggest that educational efforts that care for students' negative psychological states regarding cadaver dissections are necessary. This will enable students to form a positive attitude towards cadaver dissection leading to a meaningful educational experience.

Recommendations

These results suggest that, for medical students, the first cadaver dissection is a crucial time for self-reflection and the formation of their identity as a doctor. It is necessary to consider the perception of students in all cadaver dissections. Our findings show that the negative perspectives on a cadaver dissection can be strongly maintained before and after a dissection practice. Therefore, we suggest that an introductory programme for dissection practices is needed for students to emotionally prepare them for their experience with the dissection practice. For example, it could be

effective to help students experience the dissection practice process indirectly by using videos or virtual reality tools, and to explain what psychological states the learner might feel during the real experience of a cadaver dissection. In the case of students who face difficult psychological states, introducing cases of how other seniors have overcome difficulties could be a way to positively help regulate psychological states related to the cadaver dissection practice. Counselling or mental care programmes are also recommended for the psychological stability of students who express negative attitudes, such as fear, towards dissection prior to the dissection practice.

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Conflict of interest

The authors have no conflict of interest to declare.

Ethical approval

This study was approved by the Ethics Committee of Jeonbuk National University (JBNU No. 2016-03-015-001). Written informed consent was obtained from each participant and experimental design was explained before the questionnaires were in accordance with the Declaration of Helsinki [Ethical approval date: 2016.05.12].

Authors contributions

HHY were involved in designing the study. They collected the data, conducted the data analysis, interpreted the results, and wrote the final draft of the manuscript. SS and JKL contributed to the design of the study, supervised the interpretation of results and edited the final draft of the manuscript. All authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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