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Sindhu Mathai - PhD project on
“Visual and verbal literacies in the context of human body systems”
Questionnaires, coding schemes, analysis and results

Digestive System Phase 2 Part 2: Questionnaires with Scores Assignment

Part 2 A – Comprehension of Structure Passages

Each question carries a certain number of points which are given within brackets. Questions numbers considered in the calculation of comprehension scores are marked with *. A summary of the questions considered and the total points they carry is given after the two questionnaires.

Read the passages given below and answer the questions given below each of them. To answer the questions you may use words or drawings as you wish.

Passage 1

Understanding of function from a structural description (therefore understanding of function)

The mouth contains many teeth, one tongue and some salivary glands. We have four kinds of teeth: incisors, canines, pre-molars and molars. Incisors are the front teeth, which are flat in shape. On both sides of the incisors are the long and pointed canine teeth. Any food first comes into contact with the incisors and the canines.

Deeper in the jaw, behind the canines, are the pre-molars. The pre-molars have two points, or cusps, and are therefore called "bicuspid". Further deep inside, behind the pre-molars, are a few teeth which are the last to develop. These special teeth, called molars, have four or five points, or cusps.

The walls of the mouth cavity carry three pairs of salivary glands. Saliva secreted by these glands contains some active proteins, called enzymes. Some enzymes can convert starch into sugar. Other enzymes can kill bacteria. The saliva contains a lot of water and some slimy mucus.

The tongue is a muscular organ. It has on its surface thousands of special structures called taste-buds. There are different kinds of taste-buds for sweet, salty, sour and bitter tastes. Each of these four kinds of taste-buds are located in a specific region of the tongue.

a. Draw what you imagine could be the shapes of an incisor, a canine, a pre-molar and a molar tooth (4)

b. Draw a diagram to illustrate the position of the different kinds of teeth (1).

c. From the shape and location of each kind of tooth, what can you say about its function? Answer in the table given below. Draw diagrams if necessary (12). *

Type of tooth	Shape of tooth	Where it is located in the mouth	Probable function of this tooth
Incisor			
Canine			
Pre-molar			
Molar			

d. What could be the use of water and mucus in the saliva? Explain. (1) *

e. How does it help that the tongue is a muscular organ? What if the tongue were hard and bony? (1) *

f. A piece of roti, when chewed well, tastes sweet. Why? (1)

g. Can you taste all foods in all parts of the tongue? Why or why not? (1) *

h. Give examples of foods which have a taste that is a combination of two or more tastes. How could you detect such a taste? (1) *

i. If you cut your finger by mistake with a knife, and blood comes out of the cut, you are sometimes asked to put your finger in your mouth. Why do you think that is done? (1)

Passage 2

The oesophagus is a flexible tube. This tube begins at the back of the mouth. The walls of the tube can repeatedly relax and contract to push the food along the oesophagus.

The opening to the trachea lies close to the opening of the oesophagus. A flap of tissue called the epiglottis covers the trachea like a lid.

The oesophagus connects the mouth with the stomach. The walls of the stomach contain glands which secrete gastric juices, which are strongly acidic and act on the proteins. The inside of the stomach is lined with a thick layer of mucus which protects it from the action of these juices.

- a. Which of these words might describe the walls of the oesophagus: soft, hard, strong, flexible, bony? (2) *
- b. How do you think the food is pushed from the mouth to the stomach through the food-pipe? Make a drawing of it. (1) *
- c. Where else can you see a similar process in the human body itself? (1) *
- d. How might the epiglottis look like? Draw the trachea and oesophagus and show also the epiglottis in the drawing (1).
- e. What would happen if the epiglottis were not there? (1) *
- f. What do we do if food accidentally lands on the epiglottis or enters the trachea? (1) *
- g. After reading Passage 1 and Passage 2, what is your idea of a "gland"? About how big might be the glands mentioned in Passage 1 and Passage 2? (2) *
- h. After reading Passage 1 and Passage 2, what is your idea of "mucus"? (1) *
- i. What would happen if there were no layer of mucus on the inside of the stomach? (1) *
- j. Draw diagrams to show what the stomach looks like and what happens inside it during digestion. (2) *

Part 2 B – Comprehension of Function Passages

Each question carries a certain number of points which are given within brackets. Questions numbers considered in the calculation of comprehension scores are marked with *. A summary of the questions considered and the total points they carry is given after the two questionnaires.

Read the passages given below and answer the questions given below each of them. To answer the questions you may use words or drawings as you wish.

Passage 1

Digestion of food begins in the mouth. In our mouth we have four kinds of teeth: incisors, canines, pre-molars and molars. The teeth chew the food in the following way. First the incisors break off a piece of the food. Tough foods are torn up by the canines. Next the pre-molars and molars grind the food. This is how our teeth break up the food material into tiny pieces.

Three pairs of salivary glands in the mouth secrete saliva. Saliva mixes with the tiny pieces of food. Active proteins, or enzymes in the saliva, help convert some starch in the food into sugar. Other enzymes in the saliva kill bacteria. Mucus and water in the saliva helps us to smoothly swallow the chewed-up food.

The tongue moves the food around in the mouth to mix it with the saliva. The tongue also detects the taste of the food. Taste buds in specific regions of the tongue can detect one of four different kinds of tastes: sweet, salty, sour and bitter.

- a. Draw what you imagine could be the shapes of an incisor, a canine, a pre-molar and a molar tooth (4). *
- b. Draw a diagram to illustrate the action of the different kinds of teeth (4). *
- c. From the function of each kind of tooth, can you guess its shape and location? Answer in the table given in the next page. Draw diagrams if necessary (12). *

Type of tooth	Function of tooth	Probable shape of this tooth	Where it might be located in the mouth
Incisor			
Canine			
Pre-molar			
Molar			

- d. What could be the use of water and mucus in the saliva? Explain. (1)
- e. What do you think the tongue is made of? Could the tongue have bones in it? Could it have blood vessels? Or muscle tissue? (1) *
- f. A piece of roti, when chewed well, tastes sweet. Why? (1)

- g. Can you taste all foods in all parts of the tongue? Why or why not? (1) *
- h. Give examples of foods which have a taste that is a combination of two or more tastes. How could you detect such a taste? (1)
- i. If you cut your finger by mistake with a knife, and blood comes out of the cut, you are sometimes asked to put your finger in your mouth. Why do you think that is done? (1)

Passage 2

When food is swallowed, it goes from the mouth into the oesophagus. The food is pushed along with the help of repeated contractions and relaxations of the oesophagus.

The opening to the trachea lies close the opening of the oesophagus. As we swallow, a flap of tissue called the epiglottis closes over the top of the trachea.

The food passes from the oesophagus to the stomach. Here, proteins are acted on by strong acids known as gastric juices, which are secreted by glands in the walls of the stomach. The mucus lining inside the stomach protects it from the action of these juices.

- a. Which of these words might describe the walls of the oesophagus: soft, hard, strong, flexible, bony? (2) *
- b. How do you think the food is pushed from the mouth to the stomach through the food-pipe? Make a drawing of it. (1) *
- c. Where else can you see a similar process in the human body itself? (1) *
- d. How might the epiglottis look like? Draw the trachea and oesophagus and show also the epiglottis in the drawing. (1) *
- e. What would happen if the epiglottis were not there? (1) *
- f. What do we do if food accidently lands on the epiglottis or enters the trachea (1)?
- g. After reading Passage 1 and Passage 2, what is your idea of a "gland"? About how big might be the glands mentioned in Passage 1 and Passage 2? (2) *
- h. After reading Passage 1 and Passage 2, what is your idea of "mucus"? (1) *
- i. What would happen if there were no layer of mucus on the inside of the stomach? (1) *

j. Draw diagrams to show what the stomach looks like and what happens inside it during digestion. (2) *

Questions which probed understanding of Structure-Function relationships for the digestive system. Only these questions were taken into account while calculating mean scores for Part 2:

Part 2 a

Question nos: 1c (12), 1d (1), 1e (1), 1g (1), 1h (1), 2a (2), 2b (1), 2c (1), 2e (1), 2f (1), 2g (2), 2h (1), 2i (1), 2j (2)
Total: 28

Part 2 b

Question nos: 1a (4), 1b (1), 1c (12), 1e (1), 1g (1), 2a (2), 2b (1), 2c (1), 2d (1), 2e (1), 2g (2), 2h (1), 2i (1), 2j (2)
Total: 31

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Digestive System Phase 2 Part 2: Average scores, maximum scores and nature of questions

Questions used in calculation of Structure-Function comprehension scores are marked with *.

Part 2A	Average Score	Max score	Nature of questions
1c*	0.89	12	shape, location, function of teeth
1e*	0.82	1	what if hard and bony tongue
1g*	0.8	1	taste buds in tongue
1a	0.75	4	diagrams of teeth
1b	0.71	1	position of teeth
1f	0.6	1	chewed roti

1h*	0.5	1	examples of food, comb of tastes
2j*	0.47	2	structure of stomach, function
2a*	0.47	2	describe walls of oesophagus
2f*	0.45	1	effect of food landing on epiglottis
2c*	0.45	1	peristalsis in other organs
1d*	0.45	1	role of water and mucus in saliva
2d	0.36	1	looks of epiglottis
2h*	0.34	1	idea of "mucus"
2e*	0.32	1	what if epiglottis not there drawing of food pushed through food
2b*	0.32	1	pipe
2i*	0.25	1	what if no mucus
1i	0.18	1	fn of saliva when finger cut
2g*	0.16	2	role of gland

**Part
2B**

Q No	Score	Max score	Nature of questions
1d	0.97	1	role of water and mucus in saliva
1e*	0.85	1	what if hard and bony tongue
1c*	0.83	12	shape, location, function of teeth
1g*	0.76	1	taste buds in tongue
1a*	0.73	4	diagrams of teeth
2h*	0.62	1	idea of "mucus" drawing of food pushed through food
2b*	0.56	1	pipe
2c*	0.56	1	peristalsis in other organs
2f	0.5	1	effect of food landing on epiglottis
2i*	0.5	1	what if no mucus
2j*	0.49	2	structure of stomach, function
1f	0.44	1	chewed roti
2a*	0.43	2	describe walls of oesophagus
1h	0.41	1	examples of food, comb of tastes
2e*	0.41	1	what if epiglottis not there
2d*	0.38	1	looks of epiglottis
2g*	0.25	2	role of gland
1i	0.24	1	fn of saliva when finger cut
1b*	0.18	1	action of teeth

Part 2a

Q No Criteria for expected responses

- 1c largely depends on prior content knowledge, shape and location given in passage
- 1e quite intuitive, some imagination, helps to have knowledge of function of tongue,
- 1g prior knowledge
- 1a given in passage, some prior knowledge of appearance, the problem would be to convert into a diagram
- 1b given in passage, also from personal experience, difficulty with translating into diagram
- 1f chewed roti, inferencing, but not from passage
- 1h personal experience, no inferencing involved

- 2j shape from prior knowledge, part of function also given in passage (in terms of secreting gastric juices), but not why?
- flexible part given directly in the passage,
- 2a strong from inferencing
- 2f shape and location of epiglottis there in passage
- 2c from prior knowledge of respiratory, circulatory systems
- 1d from prior knowledge
- is there in passage, but converting into a diagram,
- 2d and relative knowledge with respect to trachea and oesophagus
- 2h cumulative understanding from description in passage 1 and 2, question requiring inferencing
- 2e knowledge of location of epiglottis, some imagination, visualisation
- description given in passage, problem in converting into a diagram,
- 2b before that understanding what the terms mean, its consequence
- 2i from content in passage, subtracting effect of mucus in stomach
- 1i from content in passage, but could be done from prior knowledge, experience
- 2g inferencing from 1 and 2, also understanding role of gland

Part 2b

Q No Criteria for expected responses

- 1d can be directly taken from the passage
- 1e quite intuitive, some imagination, helps to have knowledge of function of tongue,
- 1c largely depends on prior content knowledge, function given in passage
- 1g can be directly taken from the passage inferred from passage, even if not known earlier
- only function of teeth described in passage, if no prior knowledge,
- 1a inferencing is required from function to structure, easy if prior knowledge is there, diagrams
- 2h cumulative understanding from description in passage 1 and 2, question requiring inferencing
- description given in passage, problem in converting into a diagram,
- 2b before that understanding what the terms mean, its consequence
- 2c from prior knowledge of respiratory, circulatory systems
- 2f function of epiglottis there in passage, inference about the effect of food landing on it can be made
- 2i from content in passage, subtracting effect of mucus in stomach
- shape from prior knowledge, part of function also given in passage (in terms of secreting gastric juices),
- 2j but not why it secretes
- 1f chewed roti, inferencing, but not from passage
- 2a flexible' part given directly in the passage, 'strong' from inferencing
- 1h personal experience, no inferencing involved
- can be inferred from function of epiglottis given in passage; knowledge of location of epiglottis also required,
- 2e some imagination, visualisation
- is there in passage, but converting into a diagram,
- 2d and relative knowledge with respect to trachea and oesophagus
- inferencing from 1 and 2, also understanding of role of gland from two different functions,
- 2g requires comprehension and inferencing
- 1i from some content in passage, but could be done from prior knowledge, experience
- 1b difficulty compared with its equivalent question in Part 2a with translating into function diagrams

Effect of content on comprehension of "structure" and "function" passages

Mean scores and (s.d.)			
	2A (Structure version)	2B (Function version)	Significance Mann Whitney U
Passage 1 (mouth)	0.69 (0.20)	0.67 (0.19)	N.S.
Passage 2 (oesophagus and stomach)	0.36 (0.23)	0.47 (0.24)	$z = - 2.0, p < 0.05$
Significance Wilcoxon Signed ranks	$z = -5.7, p = 0.00$	$z = -3.7, p = 0.00$	