



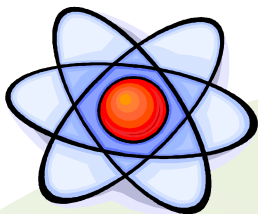
Technology Education Key Learning Area

Case Study: Students should be made aware of the relevance of the technology they are studying to the real world. Case studies on technology and design enable students to put their learning into an authentic context.

Authentic Context: Students could understand the importance of the consideration of ergonomic in the design process through two examples, namely “SpeedBlocks Head Immobilizer” and “Motorola NFL Headset, Generation II”.

Level: S3

Knowledge Context Covered: Common topic - Design & Applications



Design Process with Ergonomic



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Background

Most people have heard of ergonomics. They think it is something to do with seating or with the design of car controls and instruments. However, ergonomic means more than these. Ergonomics is the application of scientific information concerning humans to the design of objects, systems and environment for human use. Ergonomics comes into everything which involves people. Work systems, sports and leisure, health and safety should all embody ergonomics principles if well designed.

Discussion

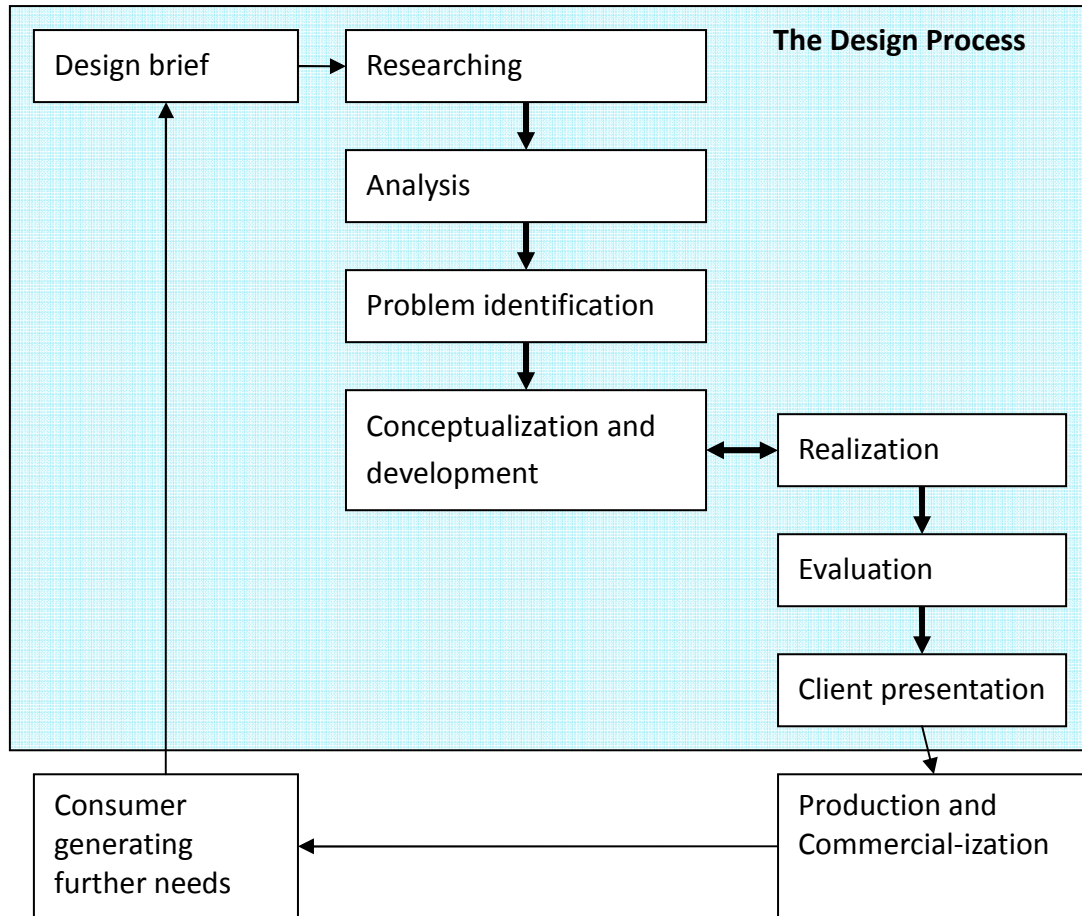
- Why is the video recorder become one of the most frustrating domestic items to operate?
- Why do some car seats leave you aching after a long journey?
- Why do some computer workstations confer eyestrain and muscle fatigue?



Such human irritations and inconveniences are not inevitable – ergonomics is an approach which puts human needs and capabilities at the focus of designing technological systems. The aim is to ensure that humans and technology work in complete harmony, with the equipment and tasks aligned to human characteristics.

Ergonomic in the Design process

When design product for human being, designer should come over on the ergonomic concerns. In reality, ergonomic problems are mostly found during the research stages. The process chart below show the whole design process, in which ergonomic concern start from the beginning to the end. The two case studies presented in this learning resource material will stick to the design flow below exploring the ergonomic consideration during the process.



The two case studies here reflect two different approaches in design, both products required the study of ergonomic. Human dimension, comfort and form will have to study during the process. However, the difference hidden is the straight forward ergonomic solution vs a commercial concern leading to an ergonomic solution. Both cases cover the handle of ergonomic information and development, but to fulfil very different needs.

Case A – SpeedBlocks Head Immobilizer, traditional process studies on ergonomic.

Case B - Motorola NFL Headset, ergonomic idea generate from commercial needs.



Case A - SpeedBlocks Head Immobilizer

The history of the immobilizer

In the world of health care, where the technological advances of the past 50 years have been dazzling, some areas remain surprising low tech.



Figure 1 - SpeedBlocks® Head Immobilizer

Only 20 years ago, emergency medical technicians (EMTs) were still placing sandbags on either side of the head to immobilize patients suspected of having incurred a spinal injury. Of course this is a clever way to prevent the patient from any further injury during the transportation to hospital. It also was an incredible design during that time. However, disadvantages is quite simple, the technician has to carry the extra weight of the sand bags instead. There will sure lower down the efficiency, or even cause career health hazards to the technicians. The sand bag also often move the patient's head cause more trouble.



Fig. 2 The immobilizer used in early years. There were 2 block of foam place on both side of the patient's head. Both effectiveness and efficiency are low.

In 1989, Laerdal Medical Corporation's design team introduced a cheap, disposable system called the Stifneck HeadBed II.

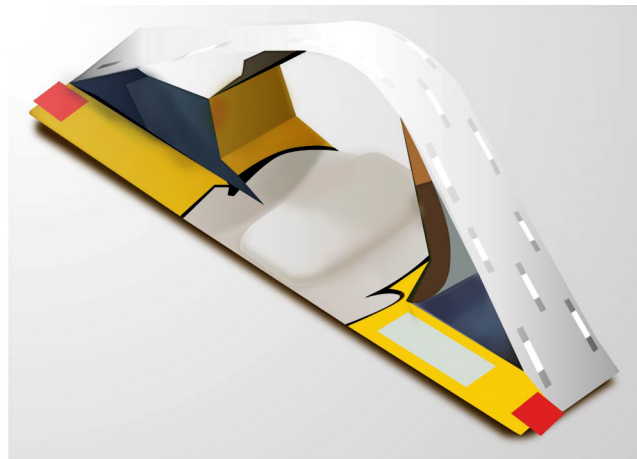


Figure 3 HeadBed™ II Head Immobilization Device

This system effectively immobilized patients, but because it was made of corrugated cardboard, many EMTs remained unconvinced of its effectiveness.

Laerdal, a world leader in creating products for the EMT and paramedic community, saw a need for a head immobilization product that was easier to keep clean than the foam blocks and that had a more convincingly sturdy appearance than the HeadBed, but that was still cheap enough to discard when needed.

"The idea was to give them something that could be reused on multiple patients until they did get into a really serious accident that was very traumatic; then, when the product got very messy, it would be inexpensive enough that they could throw it out if they wanted to", said Jim Traut, the director of design and development for Laerdal.



Research and Analysis

To understand the situation on the needs and use of immobilizer, EMTs would be receptive to the process. Uncovered requirements are found for the product. Research method including:

- Focus groups
- Field studies
- Close examination of videotapes of EMTs on job

The design brief

After the research stage the following main criteria are found:

1. It had to immobilize the patient's head, even if the patient was disoriented and struggling.
2. The essence for EMTs is time. The product should be used quick and easy in the field.
3. The product would be of open enough construction to give doctors physical and verbal access to the patient.
4. It should be flexible enough to be used on a two-year-old child or a helmeted motorcyclist.
5. The product would have to be attachable to a variety of styles of backboards, as they are not standardized.
6. The product should not interfere with x-ray.
7. It should be easily cleaned and stored.

The ergonomic concerns

Within the design criteria, ergonomic surely is the main factors in the first 4 which consider the followings:

- The mounting of head in terms of immobilize it. Size and shape of human head will have to be considered together with comfort.
- The ergonomic of the final design should help the EMTs to put on the immobilizer as effective and efficient as possible.
- Various head size from different ages and culture.
- In one hand, the product immobilizes the patient's head. On the other hand, the doctor still can communicate and examine the patient on his eyes, nose, mouth and ear.

Conceptualization

Brain storming, mind mapping and other creative process has come up of thousand of ideas.

- Holding the patient's head firmly is the first target to be achieved. Idea sketches in the early stage show that design of mechanism leading to an adjustable feature. These increases the effectiveness on immobilize the patient's head.

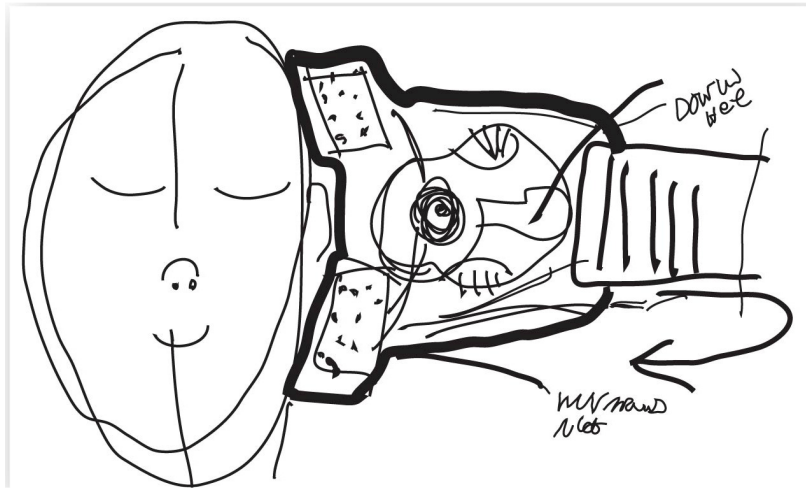
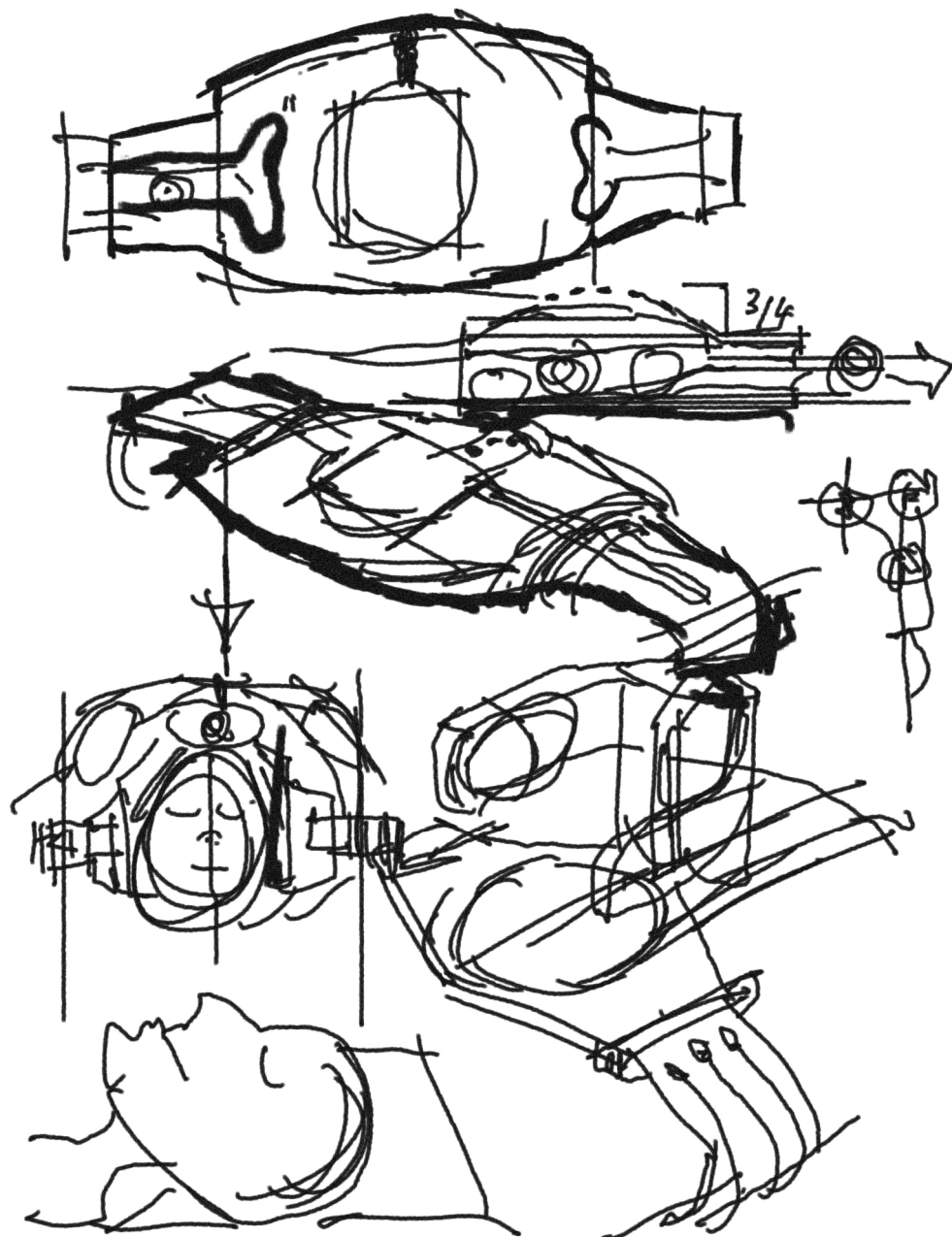


Fig. 4 & 5 idea sketch showing the primitive design considering the ergonomic on using the device in holding the patient's head





- In adjusting the knob, ergonomic concern also been taken while using the product. EMT as the user will have to be considered throughout the whole progress.

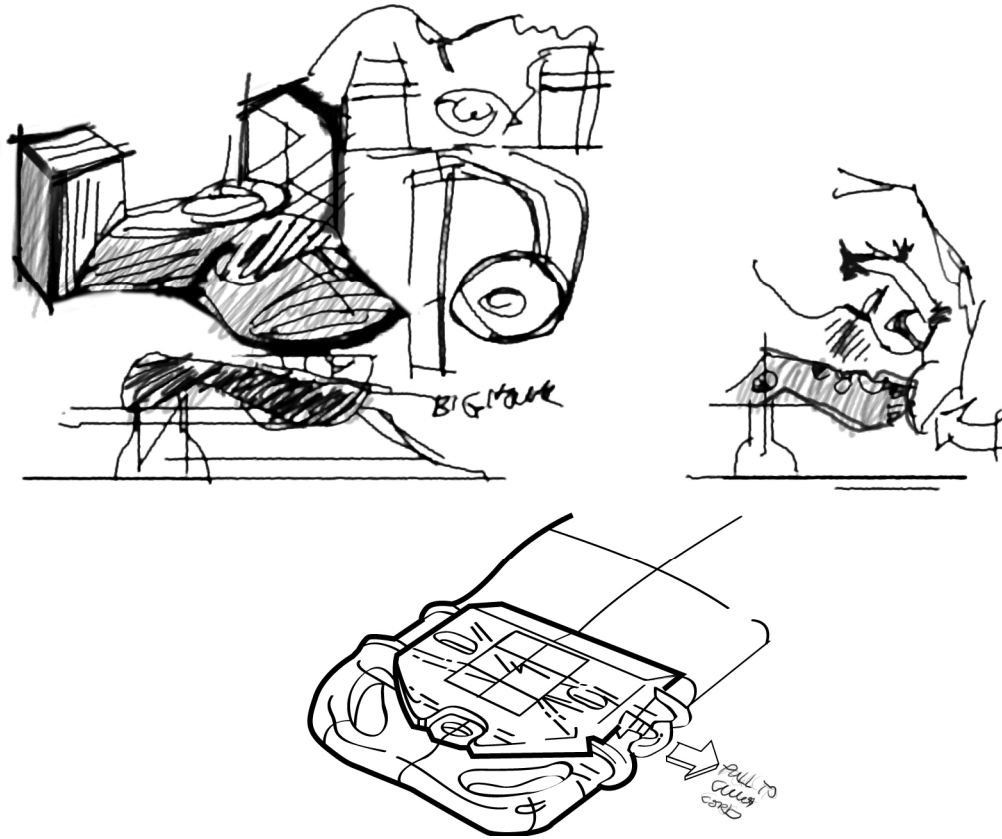


Fig. 6, 7 & 8 Sketches in early stage showing details on the controlling and adjusting parts. Ergonomic consideration also made from the EMTs point of view. As the efficiency is the key point, easy and quick to be used must be achieved in the design.

Finalizing ideas

Ideas were evaluated, and the final idea will face a series of development and modeling test. Other than the direct ergonomic concern on the last stage, the following new direction was set:

- Designer found that the product has to affixed to any size or style of backboard, as the EMTs did not restricted to one type of back board.
- Injection-molded plastic will be used, which is light weight, high strength and reliable.
- Wall thickness of plastic will be investigated for not blocking x-rays.
- Disposable head straps and block pads used for easy and low cost replacement.
- Method on space saving will be investigated fulfilling the crowded condition in the ambulance.

Development

As the basic architecture of the system was decided, the design team worked further on details with testing. Size and shape are finalized with a lot of test model with model and real human.



The ergonomic concerns in this stage include:

- The size and shape of the patient's head. Reference on human dimension is being used to make use all sizes fit.



Fig. 9

- Even in this first model, the basic concept of the structure – a universal base that can attach to any type of backboard, with plastic blocks to hold the head – is apparent.
- Ergonomic test also confirm the EMT throughout the process.
- The product should also make sure that the patient can be well treated by doctor. Patient's face should not be covered. Eyes, nose, mouth and ears can be examined by doctor. On the other hand, ensure the communication is not blocked too.



Fig. 10

- In this later model, the team kept the base and block concept but started refining the strapping mechanism used for the head. Through trying this model out on team members, they discovered that its straight-across strapping mechanism was not as effective as a slanted mechanism.



Fig. 11

- As the design team came closer to the final design, aesthetic and production elements will built up. The form of the final design provides a strong and reliable sense. The thick bar shape with straight forward details communicate clearly that it is a functional piece of design. Foam model was made firstly to identify the correct form and details.
- Tests were made on the comfort and efficacy of the arch mechanism on a wide spectrum of people, trying to find the construction that suited the largest number of people; the design team also aligned the hole with patients' ears, if possible, which would aid physicians both in diagnosing trauma and communicating with patients.

Evaluation

Development stage does not mean a smooth process which all design idea come true easily. Problem and other findings also will be discovered. Any findings can be positive, even problems can ignite improvement ideas in a positive way. Ergonomic come to the testing ground and the design become the reality.

- Ideas were generated and visualize with sketches. Although human dimension, shape and body features are considered, the full details still cannot be described at this stage.

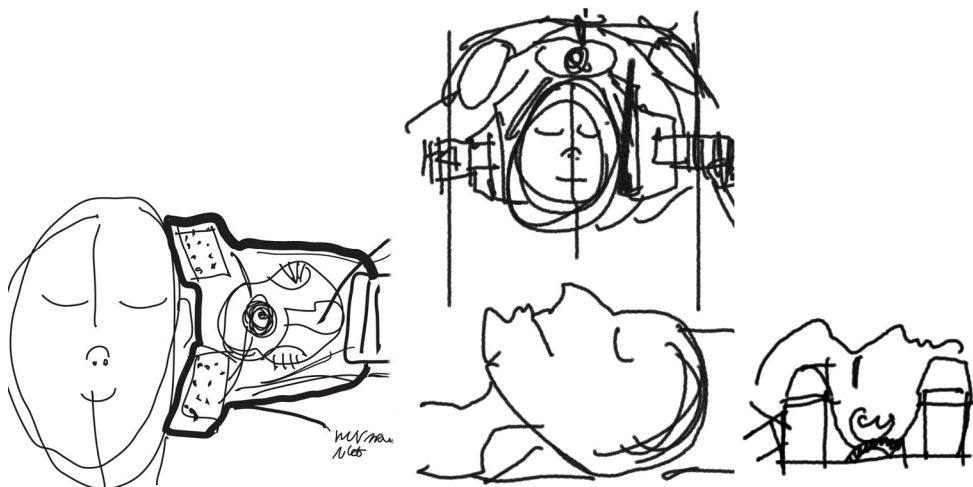


Fig. 12 sketches on the ideas considering the patient's head



- Through trial and error, the design team discovered that straps that slanted across the patient's face at an angle were more effective in holding a patient secure in the device than straps that went straight across. The first idea of parallel straps was developed from sketch to the test model. But the problem found and improved with an angled straps.

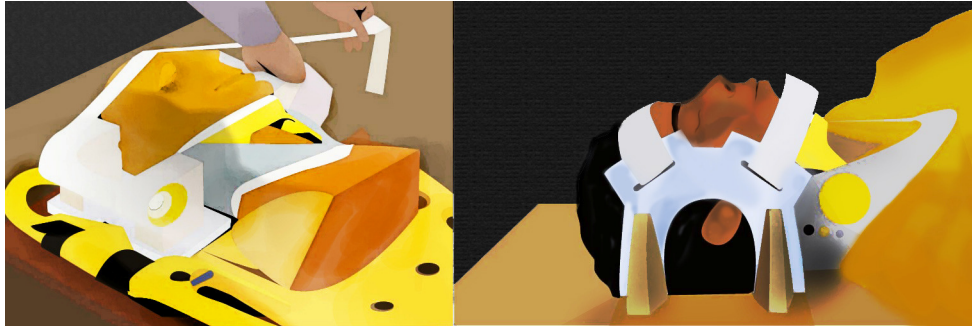


Fig. 13 an earlier test model which develop from sketch on parallel straps, and the improved model with angled straps.

- The user's comments take an essential role. Other than the input on research and idea generation, EMTs were consulted in the development. The design team explored the concept of a head immobilizer that folded to save space on a crowded ambulance. Ultimately, the idea was rejected because feedback in the field from EMTs was that speed of use was more important to them than saving space, so any additional assembly would be undesirable; the team also had trouble ensuring the stability of this concept in action.

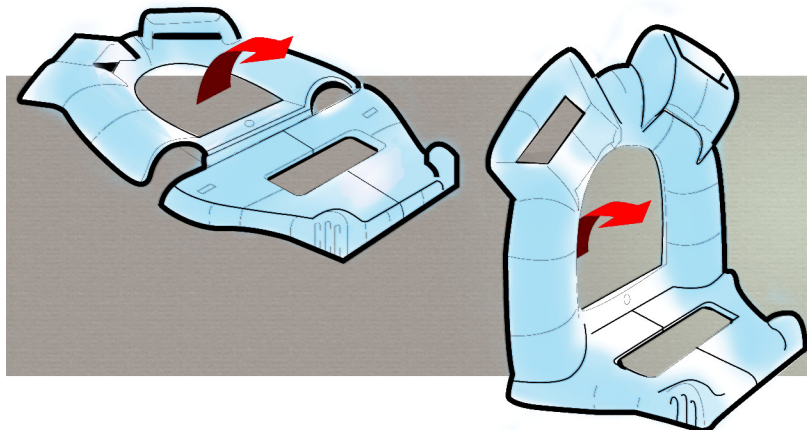


Fig. 14 Othe original sketches on the foldable holder design

Finalize design – Production and Commercialization

As the design come to the final stage, all the data from development were refined. Production and precision is the focus on the finalize design stage.

- Precise CAD model with all detail production details were produced. Follow with the CAD data, prototypes were made for load and field test. This will ensure the product would perform as desired and not flex under pressure.

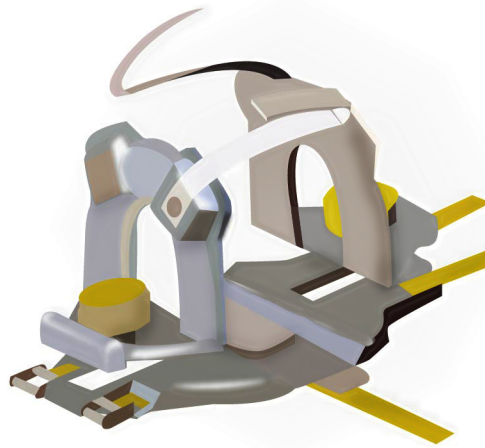


Fig. 15 CAD Model of one of the final prototypes.

- Production is not the main concept on the final design, but as many other design process, the production method was considered in a very early on. The company has already target mass product and plastic as the final production method. The design team directly moved in this direction. During the process, exploded view was drawn to analysis the assembly and components for the design.

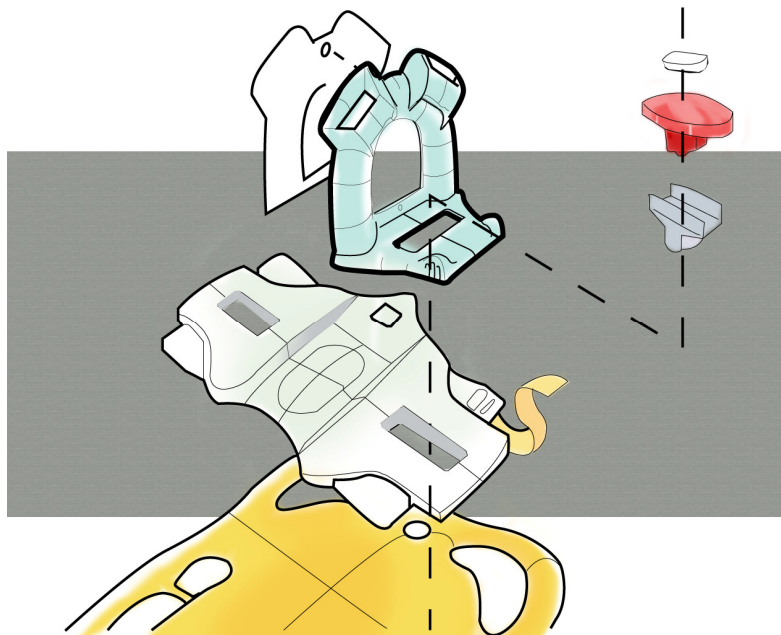


Fig. 16

- An exploded view of the final product, which shows the blocks separated from the base. Though the yellow board shown here is Laerdal's own model, the base can be strapped to any kind of backboard ahead of time.
- CAD prototypes were produced to be used in field test. The prototypes are a simulation of the real production piece which should have the same size, feature, strength and stress level. These prototypes were fitted onto a wide variety of people in checking the comfort and final size.



Fig. 17 prototypes test by wide variety of people.

- Field testing is to ensure the product can be operated under the real situation. Note that the patient is also wearing an extrication collar, the Laerdal product that gave the design team the idea of using plastic to manufacture SpeedBlocks. The field testing confirmed the security of the lock mechanism and the ease of use and cleaning, but the team discovered that their customers preferred the option of disposable pads and straps.



Fig. 18 situation during the field testing.

The field test response- further evaluation

Same as the last rethink stage, field test does not always happen to be an expected answer, surprise is always unexpected, however should still support for improvement made.

- The SpeedBlocks system was designed as an disposable unit where a large part of it can only be used once. However, as the design is so sophisticated, EMTs found it difficult to accept the disposability of the system. With these comments received, the production design was improved with only the straps and pads are disposable, the other plastic part can be reused after cleaning. This not only lowered the cost per use of the product, it also reduced the amount of material waste associated with the product by an average of over 80% compared to the original disposable head immobilizers.
- EMTs were satisfied with the performance of the SpeedBlocks on its effectiveness and efficiency. They commended its simplicity of use, ease of cleaning and excellent immobilize ability.



Case B - Motorola NFL Headset, Generation II

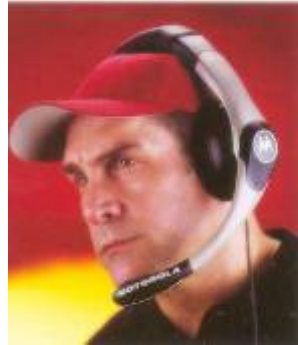


Fig. 19 The Motorola NFL Headset www.nfl.com
<http://student.acu.edu/~raa00a>

Design brief of the headset

Motorola is the company making the telecommunication products and first became sponsors of the National Football League (NFL) in 1999. Herbst LaZar Bell (HLB), a product design firm was asked to design a headset for the head coaches. The first generation headset will have to be improved.

On the Football Match, the head coaches are highly visible to millions of fans through TV board cast. Every week this team commander-in-chief will carry the headset and it is a great opportunity for the brand. It was asked to create a new version of the headset that made the most of this visibility by prominently featuring their logo on a new, higher-tech headset.

Design criteria:

1. The design had to feature the logo in a way that would cut through the clutter of the competing visuals of the TV sports environment and that would be easy to read from a variety of camera angles. The goal was for consumers to see the products on the heads of head coaches and link them to [Motorola's] consumer products.
2. Comfort is also the key, as the coach has to wear the headsets for over three hours.
3. Tough structure is required. Referring to Coach Mike Ditka's habit of tearing off his headset and slamming it on the ground, this called "the Ditka test"
4. The appearance of the headset had to make the coaches look good.



Conceptualization

Sketches with different design was made, different ideas has been explored.



Fig. 20 concept sketches on the headset

Development

After the concept stage, more refined concept sketches were presented to the coaches. Size and location were carefully considered.

- The design team explored a number of variations on a configuration where the yoke of the headset wrapped around the back of the head rather than the top, to allow for one more logo placement. The coaches expressed concern about the security of the headset in that configuration, especially when hats or sunglasses were removed.

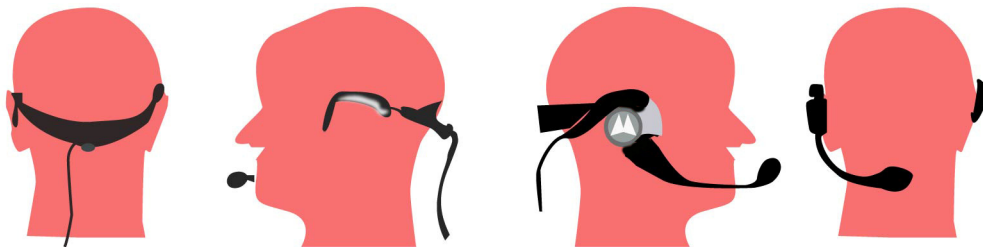


Fig. 21 refine sketches for showing to the coaches

- The style of some of these early concepts was considered too futuristic and not rugged enough by the coaches.
- The idea of having the logo appear at the back fulfill the brief set by Motorola, however, from the ergonomic concern, it is not a improvement solution and been rejected by the user.
- A wide variety of shapes and colors were contemplated for the ear-cup. The design team worked to find a shape that felt comfortable and blocked out noise well. A larger version of the ear-cup ended up working better for these purposes.
- To counteract the cup's size and to make it less visible, the designers chose to make it black.



Fig. 22 Test model of the ear-cup

- 3D CAD modeling of a human head was used to help the designers visualize the interaction of the ear-cups and microphone as well as the fit of the headset.

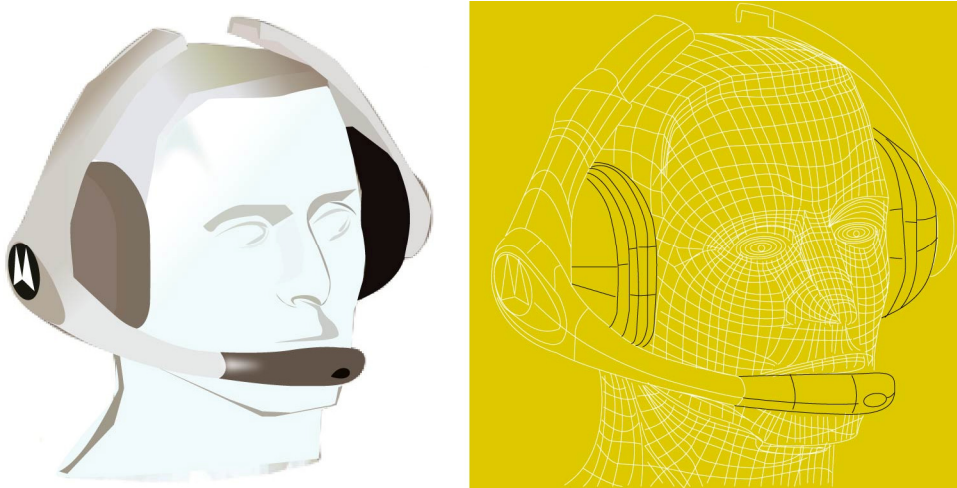


Fig. 23 CAD model

Ergonomic concern

- The back strap design for headset is not a new thing, this has been employed in other Motorola handset. It was proof that there would be no ergonomic problems on this design. The first advantage it has is having the logo at the back. However, this new wearing format is not an acceptable solution to the user. So users' comments play an important role during the process.



Fig. 24 Refined sketches on the headset



- The ear-cup is the most important ergonomic design in the headset. As the noise resistance is the functional needs, the large size ear-cup is not a debatable fact. Test with full size models must be done to make sure the comfort. In terms of the visual aspect and lower the massive sense, black is used to hidden the huge size.
- The coaches request to have a larger mouthpiece, which can help to avoid the other coaches from lip reading when they were calling a play. This seems to be contradicting with the technology and ergonomic, as more unnecessary materials create extra weight which may not resulting comfortability. However, this request is being reasonable in the high competitive sport game.
- To visually balance the large mouth piece, the boom of the mouth piece was designed to be more substantial. This strong design also is suitable in real situation as the coaches might remove their headsets up to 100 times during a game. They almost always grabbing the headset by the boom.



Fig. 25 the headset in use on location

- Material used carefully to enhance the handling feeling. Sandoprene TPE was over-molded for the mouth piece for better tactile grip. The microphone boom was coated with elastomer, which is easy to bend and twist, allowing to adjust the position of the microphone.
- The headset was designed to rise from the top of the weaver's head, allowing air to flow and reducing pressure on the top of the head.
- Both single and dual ear-cup version were developed. For single ear-cup, it was designed to be reversible, allowing the coach to position the ear-cup on either side. Finally there were 2 logos appear on the mouth piece to ensure visibility in either configuration.



Ergonomic on both Cases

There are numbers of ergonomic concerns during the design process for both cases. As both are closely related to the human head, ergonomic sure will be the main subject. However, different needs led to different ergonomic design. The Motorola NFL Headset is a different case which is different from the traditional ergonomic requirement of the SpeedBlocks Head Immobilizer. The following compare both case to enhance students' understanding on ergonomic.

Similarity

1. Both cases are design mould on human being. Physical Dimension on human head has under reference support.
2. Both cases are having strong research from the users with different research method, e.g. focus groups, field visit.
3. Both cases consider the process on using the design, ergonomic design solution has fulfilled the user's needs.
4. Both cases went through detail process with sketches and test model
5. CAD was used in both cases for the study of ergonomic.
6. New ergonomic findings found during the development stage with test model. Angled straps used for the immobilizer. The boom of the Motorola headset has be reinforced in structure.
7. Both cases have failed design details and been rejected by user during the finalize designs stage. The immobilizer finally did not have a foldable details. The Motorola head set finally did not have back wrapped design.
8. Both cases have gone through field testing in ensuring the ergonomic details.

Difference

1. The needs for the design are different. Although both are improvement from the last version of product, the immobilizer's needs is on ergonomic, the Motorola headset is on the advertising of the brand.
2. Original design concept is from different needs. The immobilizer is straight forward in using ergonomic to solve ergonomic problems. The Motorola head set using ergonomic to solve an advertising problem. E.g. idea on the back wrapped design and enlarged mouth piece.
3. Privacy is considered in the Motorola head set, but not the immobilizer. The large month piece designed to avoid lip reading from the opponent. This design affects the weight, structure and aesthetic, some parts create other ergonomic problem.
4. The immobilizer considered as a universal design which should fulfill requirement from



- different people with different age, size, and culture.
5. For ergonomic, the Motorola headset is mostly consider the coaches. The immobilizer considered ergonomic both users, the patient and the EMTs.
 6. The immobilizer considered method of adapting other equipments (the spineboard), the Motorola headset being individual during operation.
 7. The immobilizer consider the wastage problem created, with design morality, designer only use disposable material when necessary. Motorola head set did not have this consideration.



Self-assessing Questions

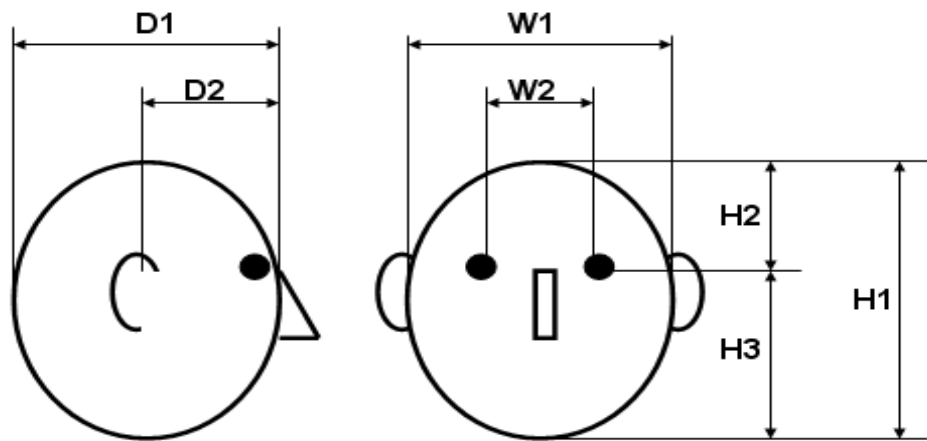
Worksheet Code:	D&T/CS-Erg-WS01	Date: ____/____/____
Name:	()	Class:
Activities:	Self-assessing	
Objective:	1. To assess the understanding of the case study topic. 2. To conceptualize the topic through information search and group discussion.	
1	What are the items in the design process?	
2	Who are the users of the SpeedBlocks Head immobilizer?	
3	List out the consideration of the design brief for the SpeedBlocks head immobilizer?	
4	What design detail was rejected by the EMTs?	
5	What is the name of the test that a final model was tested on site by the user?	
6	What is the benefit of having a back wrapped design feature for the Motorola headset?	
7	List out the difference between the Motorola headset and the immobilizer project?	
Teacher remarks:		



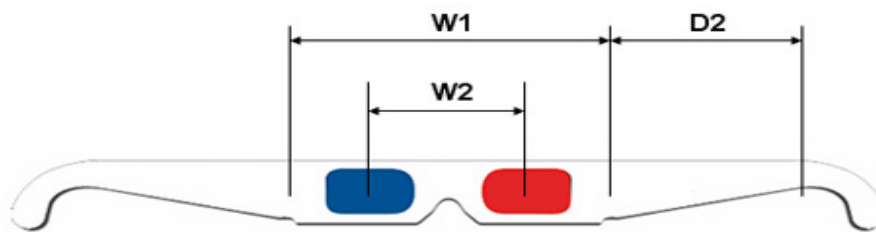
Class Assignment and Worksheet

Assignment 1 – Making paper card glasses

Worksheet Code:	D&T/CS-Erg-WS02	Date: ____/____/____
Name:	()	Class:
Objective:	<ul style="list-style-type: none">▪ To assess the understanding of human dimension via design process.▪ To conceptualize the topic through information search and group discussion.	
1	Task	
	Students are asked to group themselves with 5 students. Each group is asked to make research and produce a paper glasses by themselves.	
2	Steps	
	<ul style="list-style-type: none">▪ Measure the dimension of their heads and fill in the dimension data sheet. All dimension are in cm.▪ According to the dimension they have, make paper glasses with card individually according to their individual dimensions.▪ Mark the size Large, Medium and Small on the 3 selected glasses.▪ Make conclusion on the best model in your group.	
3	Trial test	
	<ul style="list-style-type: none">▪ Select the 3 paper glasses and mark the size Large, Medium and Small.▪ Each student tries wearing them, compares with their individual glasses and scores them on the list.	
5	Statistic	
	What are the size of glasses in your group: <ul style="list-style-type: none">▪ No. of Large glasses:▪ No. of medium glasses:▪ No. of small glasses:	
6	List down the size of glasses with highest and lowest score and write down the reasons on both.	
Teacher remarks:		



Name of student	W1	W2	H1	H2	H3	D1	D2





Size of the glasses	Large			
	For answer “Yes” - 1 mark, “No” - 0 mark			
Name of student	Is it comfortable?	Is it not loose?	Is it not too tight?	Total score:
			Total:	

Size of the glasses	Medium			
	For answer “Yes” - 1 mark, “No” - 0 mark			
Name of student	Is it comfortable?	Is it not loose?	Is it not too tight?	Total score:
			Total:	


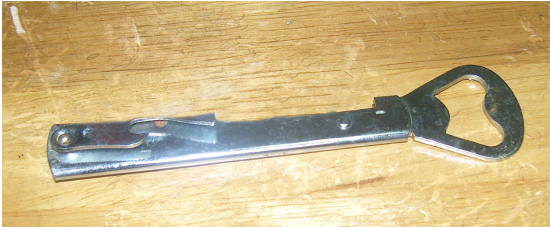

Size of the glasses	Small			
	For answer “Yes” - 1 mark, “No” - 0 mark			
Name of student	Is it comfortable?	Is it not loosen?	Is it not too tight?	Total score:
			Total:	



Assignment 2 – Product analysis

Worksheet Code:	D&T/CS-Erg-WS03	Date: ____/____/____
Name:	()	Class:
Objective:	<ul style="list-style-type: none">▪ To assess the understanding on factors affecting the ergonomic performance.▪ To conceptualize the topic through information search and group discussion.	
1	Task	
	Students are asked to compare 3 designs with different ergonomic design and list out the factors affecting their ergonomic performance.	
2	Steps	
	<ul style="list-style-type: none">▪ Group yourself into 5 students.▪ Analysis each design and write down the advantages and disadvantages concerning the following factors: Comfort ability, convenience, aesthetic, production	



3	Analysis
	<div data-bbox="638 280 901 555"></div> <div data-bbox="914 526 1021 560">Design A</div> <div data-bbox="411 562 560 595">Advantages:</div> <div data-bbox="411 622 1220 667"></div> <div data-bbox="411 703 593 736">Disadvantages:</div> <div data-bbox="411 763 1220 808"></div> <div data-bbox="493 808 1045 1034"></div> <div data-bbox="1058 1008 1165 1041">Design B</div> <div data-bbox="411 1043 560 1077">Advantages:</div> <div data-bbox="411 1104 1220 1149"></div> <div data-bbox="411 1184 593 1218">Disadvantages:</div> <div data-bbox="411 1245 1220 1290"></div> <div data-bbox="544 1290 970 1550"></div> <div data-bbox="1007 1534 1114 1568">Design C</div> <div data-bbox="411 1570 560 1603">Advantages:</div> <div data-bbox="411 1630 1220 1675"></div> <div data-bbox="411 1711 593 1744">Disadvantages:</div> <div data-bbox="411 1771 1220 1816"></div> <div data-bbox="264 1854 1244 2033"><p>Teacher remarks:</p></div>



Assignment 3 – Product design

Worksheet Code:		D&T/CS-Erg-WS04		Date: ____ / ____ / ____	
Name:	() () () ()			Class:	
Objective:	<ul style="list-style-type: none"> ▪ To practice design with concerning on ergonomic ▪ To go through the whole design process with skill for each stage ▪ To record the process and communicate to audience 				
1	Task				
	Investigate a domestic ergonomic problem from one of the following area: Using an iron Using a Chinese wop and ladle Using a chopping knife Using a peeler Using a pair of scissors Using a toilet pump Try to design a new handle for the tool.				
2	Choosing the topic				
	<ul style="list-style-type: none"> ▪ Group yourself into 4 students. ▪ Analysis each design area with discussion and decide on one area to work. 				
3	What analysis your team has made on the topic suggested?				
4	What is your final topic chosen?				
5	Submission				
	All worksheets, final PowerPoint presentation, drawings and models				



Assignment 3a - Responsibility and Duty

Worksheet Code:	D&T/CS-Erg-WS05	Date: ____/____/____
Name:		Class:
Objective:	<ul style="list-style-type: none"> ▪ To empower students to take responsibility of their learning ▪ To provide an authentic scenario for their learning. 	
Post	Duty and responsible person	
Design coordinator	<hr/> Responsible in leading the team through out the whole design process	
Designer	<hr/> Responsible in summarizing design problem, solution and development from all members.	
Editor	<hr/> Responsible in leading the recording team in producing a full details PowerPoint presentation for audience.	
Recording assistance	<hr/> Responsible in collecting all recorded material, organize and prepare presentation.	
Designer's Assistance	All team members are Designer's assistance with their creative mind.	



Assignment 3b - Research on ergonomic

Worksheet Code:		D&T/CS-Erg-WS06		Date: ____ / ____ / ____	
Name:	Design Coordinator:		Class:		
	_____ ()				
	Designer:				
		_____ ()			
Task	Problem identification				
Objective:	To practice research and investigating problem on ergonomic				
Design area	(e.g. problem in using an iron)				
Key area	Here are some key areas that you can consider while analysis the existing design solution: Size Comfort Effectiveness Efficiency Aesthetic The working process How it was used The user Other related utensil using				
What has been done?					
Problems found					
Teacher remarks:					



Worksheet Code:		D&T/CS-Erg-WS07		Date: ____ / ____ / ____	
Name:	Editor:		Class:		
	_____ ()				
	Recording assistance:				
		_____ ()			
Task	Recording design stage – Problem identification				
Objective:	To practice research and investigating problem on ergonomic				
Design area	(e.g. problem in using an iron)				
What has been done?					
What was recorded?					
Teacher remarks:					

Worksheet Code:		D&T/CS-Erg-WS08		Date: ____ / ____ / ____	
Name:	Design Coordinator:		Class:		
	_____ ()				
	Designer:				
		_____ ()			
Task	Conceptualization – idea generation				
Objective:	To practice idea generation for solving identified problems				
Design area	(e.g. problem in using an iron)				
Key area	Base on the problem listed in last stage, generate 12 design ideas (3 ideas from each assistance designer)				
What has been done?					
Design ideas	(can be attached to extra sheet of paper)				
Teacher remarks:					



Worksheet Code:		D&T/CS-Erg-WS09		Date: ____/____/____	
Name:	Editor:	_____ ()		Class:	
	Recording assistance:	_____ ()			
Task	Recording design stage – Conceptualization				
Objective:	To practice recording details on design stages				
Design area	(e.g. problem in using an iron)				
What has been done?					
What was recorded?					
Teacher remarks:					

Worksheet Code:		D&T/CS-Erg-WS10		Date: ____/____/____	
Name:	Design Coordinator:	_____ ()		Class:	
	Designer:	_____ ()			
Task	Conceptualization – Development				
Objective:	To practice detail development of selected design idea				
Design area	(e.g. problem in using an iron)				
Key area	Compare the ideas from last stage, select the 3 most possible solution for testing model.				
What has been done?					
Design development solution	(can be attached to extra sheet of paper, with photo)				
Teacher remarks:					



Worksheet Code:		D&T/CS-Erg-WS11		Date: ____/____/____	
Name:	Editor:	_____ ()		Class:	
	Recording assistance:	_____ ()			
Task	Recording design stage – development				
Objective:	To practice recording details on design stages				
Design area	(e.g. problem in using an iron)				
What has been done?					
What was recorded?					
Teacher remarks:					

Worksheet Code:		D&T/CS-Erg-WS12		Date: ____/____/____	
Name:	Design Coordinator:	_____ ()		Class:	
	Designer:	_____ ()			
Task	Conceptualization – Finalize Design Solution				
Objective:	To practice visualization of the final design solution				
Design area	(e.g. problem in using an iron)				
Key area	Finalize the very best design solution (can combine ideas), produce the most final detail design with model and drawings.				
What has been done?					
Final Design solution	(can be attached to extra sheet of paper, with photo)				
Teacher remarks:					



Worksheet Code:		D&T/CS-Erg-WS13		Date: ____/____/____	
Name:	Editor:		Class:		
	_____ ()				
	Recording assistance:				
	_____ ()				
Task	Recording design stage – finalized design solution				
Objective:	To practice recording details on design stages				
Design area	(e.g. problem in using an iron)				
What has been done?					
What was recorded?					
Teacher remarks:					



Assessment Rubrics for Final Presentation (design presentation)

The checklist rubric

Student Name: _____		Team: _____	
Focus of Assessment: Teamwork		Date: ____/____/____	
Criteria	Self	Peer	Teacher
1. I understand the lesson objectives.	Yes / No	Yes / No	Yes / No
2. I work with team members cooperatively.	Yes / No	Yes / No	Yes / No
3. I give my views responsibly.	Yes / No	Yes / No	Yes / No
4. I respect and listen to other members' ideas.	Yes / No	Yes / No	Yes / No
5. I can draw conclusion after this lesson.	Yes / No	Yes / No	Yes / No
6. I am satisfied with my learning today.	Yes / No	Yes / No	Yes / No

The peer assessment rubric

Peer Assessment for Final presentation																	
Team:					Date:					_/_/_							
Assessors:					Class:												
Focus	No	Scores				Assessment Criteria					Scores						
Knowledge	1	1	2	3	4	5	Understanding of the topic					6	7	8	9	10	N/A
	2	1	2	3	4	5	Content is consistent with the topic					6	7	8	9	10	N/A
	3	1	2	3	4	5	Content is supported with evidence					6	7	8	9	10	N/A
	4	1	2	3	4	5	Content is at appropriate level.					6	7	8	9	10	N/A
	5	1	2	3	4	5	Show key concept in content.					6	7	8	9	10	N/A
Attitude	6	1	2	3	4	5	Show effort in group discussion					6	7	8	9	10	N/A
	7	1	2	3	4	5	Show effort in information search					6	7	8	9	10	N/A
	8	1	2	3	4	5	Show effort in preparing presentation.					6	7	8	9	10	N/A
	9	1	2	3	4	5	Show competency in IT skills.					6	7	8	9	10	N/A
	10	1	2	3	4	5	Show organization skills.					6	7	8	9	10	N/A
Presentation	11	1	2	3	4	5	Present their views and idea clearly.					6	7	8	9	10	N/A
	12	1	2	3	4	5	Logical and consistent flow of ideas					6	7	8	9	10	N/A
	13	1	2	3	4	5	Have interaction with audiences					6	7	8	9	10	N/A
	14	1	2	3	4	5	Show appropriate use of visual aids					6	7	8	9	10	N/A
	15	1	2	3	4	5	Have eye contact with audiences					6	7	8	9	10	N/A
Total Scores																	

* Performance descriptors: 1 is incomplete; 5 is fair; 7 is good; 8 is very good; 9 is outstanding effort and 10 is excellent.



References

1. Lynn Haller and Cheryl Dangel Cullen, Design Secrets: Products 2, Page One Publishing Private Limited. 2006
2. Laura Slack, What is Product Design? Page One Publishing Private Limited, 2006
3. <http://www.sizechina.com>
4. <http://www.laerdal.co.uk/document.asp?subnodeid=10926843>
5. <http://www.ergonomics4schools.com>
6. <http://www.ergonomics.org.uk>

