

Ergonomics for Beginners Industrial Design Perspective

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Module No. # 09

Performance Support and Design Intervention

Lecture No. # 35

Occupational safety and stress at workplace in view to reduce the potential fatigue, errors, discomforts and unsafe acts

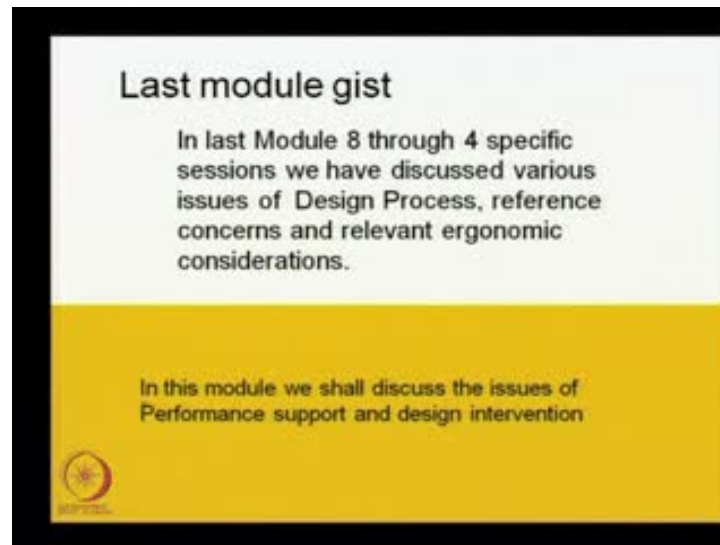
Welcome to this thirty-fifth session of ergonomics for beginners industrial design perspective.

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Ergonomics for beginners Industrial design perspective		
Modules	Area of discussion	No. of classes
Module 1	Introducing Ergonomics and content details	2
Module 2	Discipline approach: Ergonomics/ Human Factors	5
Module 3	Human physical dimension concern	7
Module 4	Posture and movement	
Module 5	Behaviour and perception	5
Module 6	Visual Issues	2
Module 7	Environments Factors	1
Module 8	Ergonomic design process	4
Module 9	Performance support and design intervention	5
Module 10	Design Ergonomics in India: scope for exploration	1

Now, the current module is module number 9, the performance support and design intervention.

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So, last module, the gist what we discussed is that, in last module **number 8 - through 4 specific sessions** - we have discussed various issues of design process reference, concerns and relevant ergonomic considerations. In this module, we shall discuss the issues of performance support and design intervention.

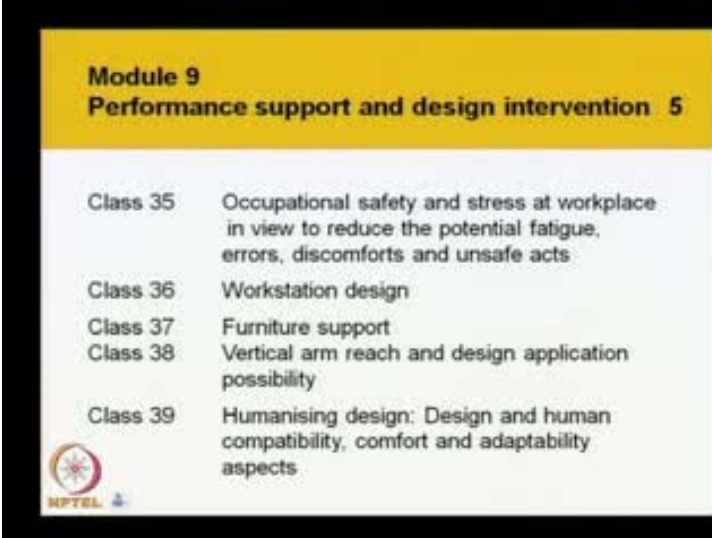
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Considerations are to be made: design for health and safety; occupational risk management; work schedule and sustained performance; psychosocial approach in


occupational health; manual material handling; work related musculoskeletal - disorders specifically disorders of the upper extremities; warning and risk perception.

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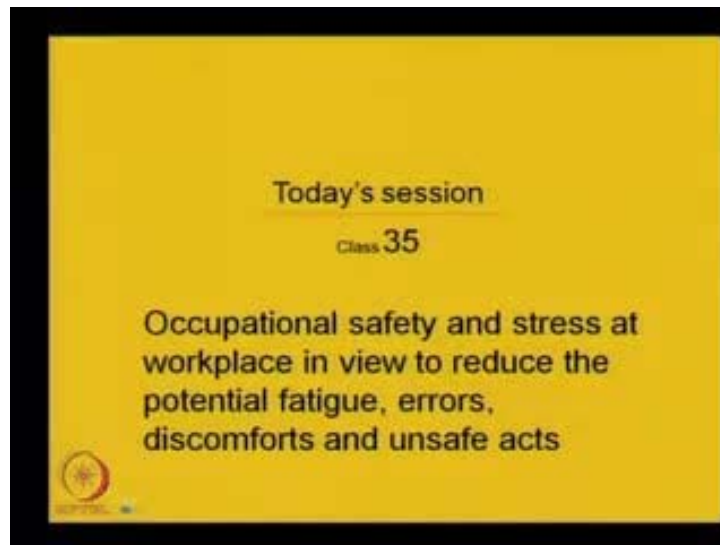
Module 9
Performance support and design intervention 5

Class 35	Occupational safety and stress at workplace in view to reduce the potential fatigue, errors, discomforts and unsafe acts
Class 36	Workstation design
Class 37	Furniture support
Class 38	Vertical arm reach and design application possibility
Class 39	Humanising design: Design and human compatibility, comfort and adaptability aspects

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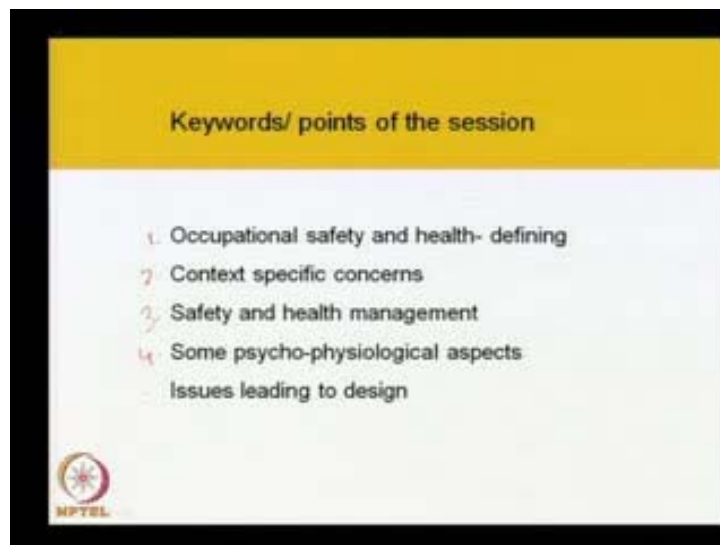
In this module number 9, the performance support and design intervention, total 5 classes are there, the class number 35, is at occupational safety and stress at workplace in view to reduce the potential fatigue, errors, discomfort and unsafe acts. Class number 36 will be, workstation design issues. Class number 37, furniture support. Class 38, vertical arm reach and design application possibilities. Class number 39, humanizing design: Design and human compatibility comfort and adaptability aspects.

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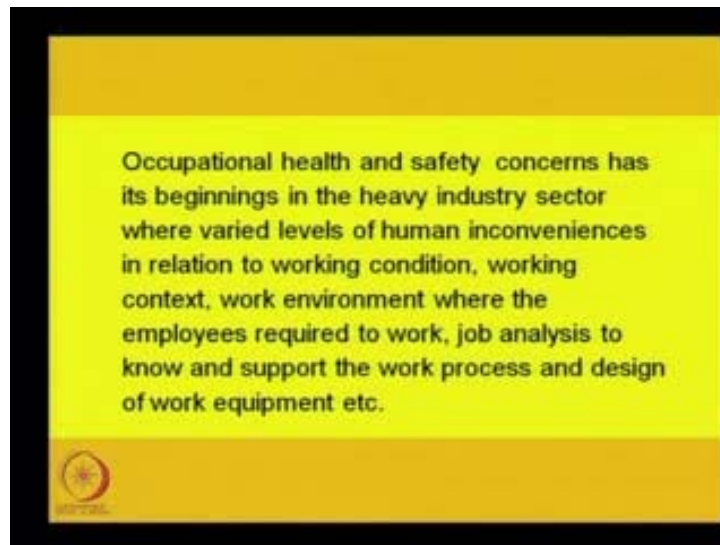
So, today's session the class number 35, is occupational safety and stress at workplace in view to reduce the potential fatigue, errors, discomforts and unsafe acts.

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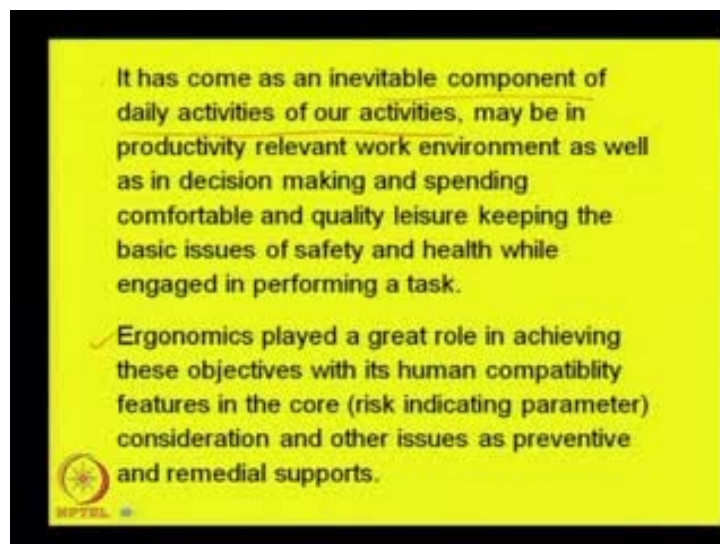
The keywords and points of this session are occupational safety and health- defining, context specific concerns, safety and health management, some psycho-physiological aspects relevant for this and issues leading to design.

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So, occupational health and safety concerns has its beginnings in the heavy industry sector where varied levels of human inconveniences in relation to working condition, working context, work environment where the employees required to work, job analysis to know and support the work process and design of work equipment etcetera, are normally discussed.

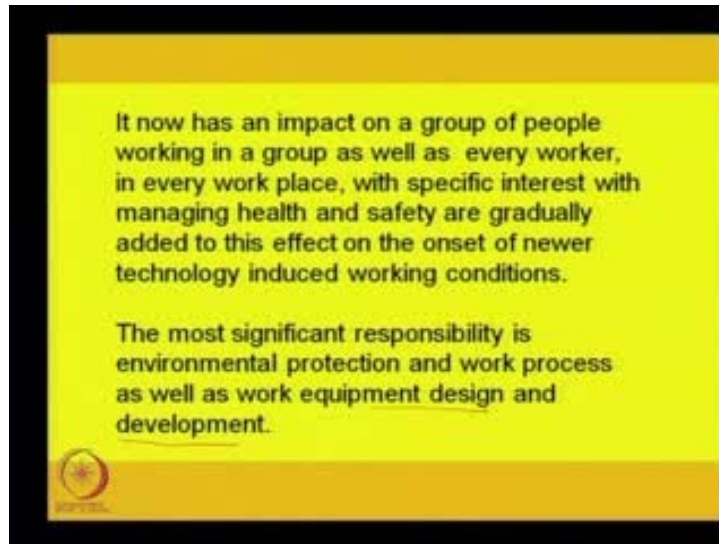
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It has come as an inevitable component of daily activities of our life, may be in productivity relevant work environment as well as in decision making and spending

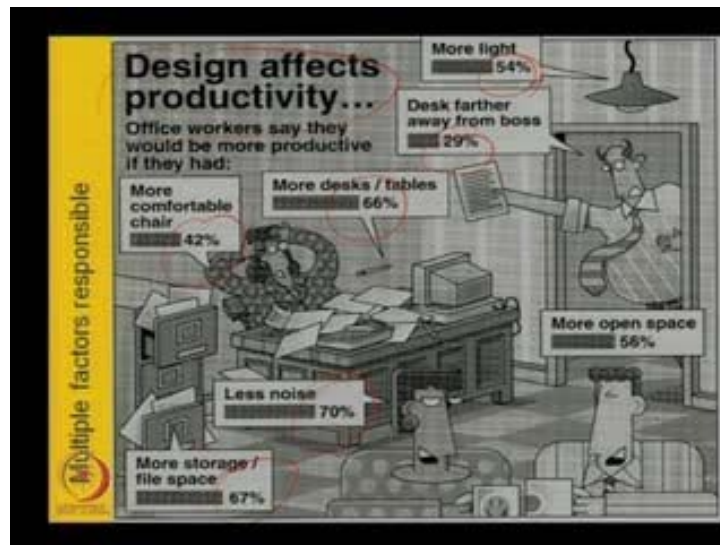
comfortable and quality leisure keeping the basic issues of safety and health while engaged in performing a task. Ergonomics plays a great role in achieving these objectives with its human compatibility features in the core that is the - risk indicating parameters - considerations and other issues as preventive and remedial supports.

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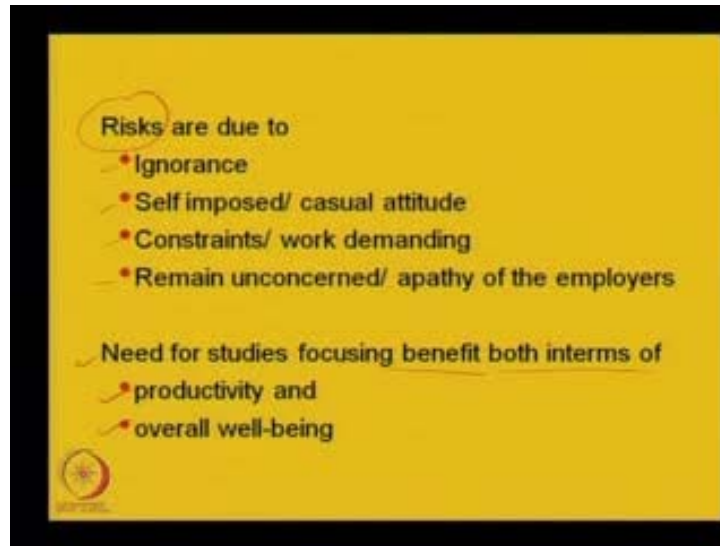
It now has an impact on a group of people working in a group as well as every worker, in every workplace, with specific interest with managing health and safety are gradually added to this effect on the onset of newer technology induced working conditions. The most significant responsibility is environmental protection and work process as well as work equipment design and development.

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Now, multiple factors are responsible for a working area to be perceived as good. Now, in this figure, we have earlier also mentioned that so in the same figure is that it about design affects productivity under this. The many concerns are there are expressed by people like, if they had more light around, 54 percent of workers, they said that they their performance would have been better desk further away from boss that is a privacy aspect, 29 percent responded like that one more comfortable chair, if it is there then 42 percent people expressed they could perform better more desk and table space requirement, expressed by 66 percent of a study population less noise, 70 percent more storage file space, 67 percent more open space requirement, around 56 percent of study population mentioned they could perform better. So, it was based on an available study source that is already published.

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Now, with this what risks are actually coming that we need to address. So, that in working area in a workplace safety and health can be improved.

The risks are due to ignorance of the facts, self-imposed or cause a casual attitude, if someone does not take care constraints and work demanding posture or that work area, remain unconcerned apathy of the employers like if it is not clearly understood that due to unsafe work condition and health problems, if workers are not able to perform their duty as desired, then ultimately it is going to be a loss, if we do not recognize this fact by the management group, then this risks are there on the workers and the productivity will also affect like with that. So, what is required the need for studies focusing benefit both in terms of productivity increment, as well as overall well-being that feeling of the persons who are involved in that.

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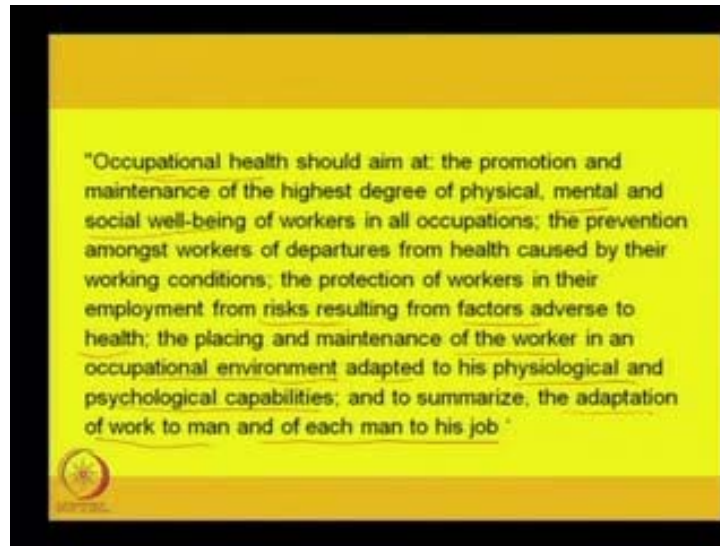
So, it can be said that in this figure, it is said that if I am productive with comfort at home and at workplace, it can be said that ergonomics is in effect. Now, what are the factors that gives this feeling.

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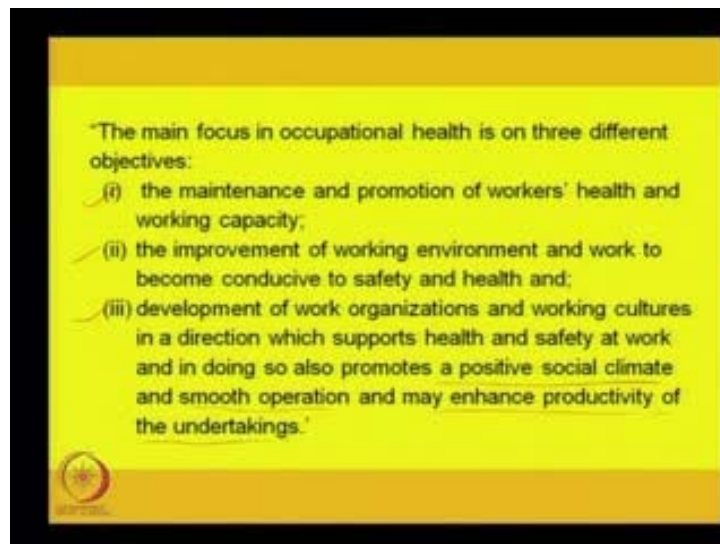
The domain specification was adopted by the joint committee - the International Labour Organization - ILO and the World Health Organization WHO - on occupational health at its first session in 1950 and revised at its twelfth session in 1995. So, the definition reads like this.

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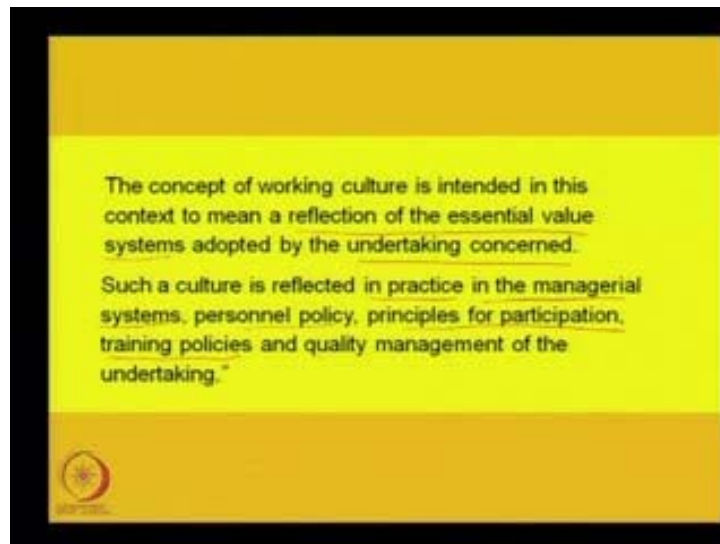
“Occupational health should aim at the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention amongst workers of departures from health causes by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological capabilities; and to summarize, the adaptation of work to man and of each man to his job”

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It continues like this, “the main focus in occupational health is on three different objectives: (i) the maintenance and promotion of workers health and working capacity; (ii) the improvement of working environment and work to become conducive to safety and health and (iii) development of work organizations and working cultures in a direction which supports health and safety at work and in doing so also promotes a positive social climate and smooth operation and may enhance productivity of the undertakings”

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The concept of working culture is intended in this context to mean a reflection of the essential value system adopted by the undertaking concerned. Such a culture is reflected in practice in the managerial systems, personal policy principles, for participation training policies and quality management of the undertaking”

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So, implications of occupational health and safety it has 3 aspects, the moral aspect, legal aspect and economic aspect. The moral aspect it mentions that due to reasonable care: unacceptability of putting health and safety of people at risk; society's attitude to moral obligations: making the moral case to senior management, for legal the preventive – enforcement - punitive - through criminal sanctions - and compensatory effects of law. Now, economic direct and indirect costs associated with incidents and or unhealthy workplaces and their impact on the organization that - includes insured and uninsured costs.

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The slide is titled "Safety and health management" and contains a bulleted list of hazard management strategies. To the right is a newspaper clipping about a city's law on puffing. Below the clipping are three checkmarks with text: "Needing dignified personal space", "Allowance/ tolerances ?", and "Personal/ public". A small NPTEL logo is in the bottom left corner.

Safety and health management

- Elimination of workplace hazards
- Hazards that are physically infeasible to correct (install a drain to remove water that occasionally collects around the die-casting area)
- Hazards that are physically feasible, but are economically infeasible to correct (post a warning sign that advises forklift truck drivers to slow down)
- Hazards that are economically and physically feasible to correct (improve sanitation by cleaning the rest room more frequently)

city
Dispur law on puffing goes up in smoke

✓ Needing dignified personal space
✓ Allowance/ tolerances ?
✓ Personal/ public

So, safety and health management, issues. The elimination of workplace hazards, how it can be reduced? We can eliminate the workplace hazards after identifying hazards that are physically infeasible to correct - install a drain to remove water that occasionally collects around the die casting area. In an workshop hazards that are physically feasible, but are economically infeasible to correct like, post a warning sign that advises forklift truck drivers to slow down. Hazards that are economically and physically feasible to correct like a improve sanitation by cleaning the rest room more frequently. Now, in this case, an additional element would be **needing** defined personal space. Now, what will be the allowance and tolerance values and how you can make a work area personal and public, these issues we need to be consider.

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Now, some psycho physiological aspects of these issues, what we should consider, I think that safety versus health, if work condition is not safe then automatically, it will effect on the health safety deals with acute effects of hazards, whereas health deals with chronic effects of hazards, workplace violence - it also can effect on this issue, concept of hazardous avoidance, the enforcement approach - the safety rules fines penalties etcetera, the psychological approach, religion versus science like some people they follow their the inbuilt or automatic safe work habits. Some tips may be given through religious faith and etcetera, top management support is necessary by reward recognition organizing safety programs for their workers like that.

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So, these are the some of the issues one can concern but in this figure, whatever is seen here, the design of the machine. This is a lock manufacturing industry's work. Now, the person, he has to operate in so many areas where he is not adopting this work posture with his own will this is by the job demand.

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Now, how whether job can be modified this. Another figure is also mentioned the same thing. Here also the some of the development that is possible to do.

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Now, the person has to work in a confined space, what type of development can be done here. Obviously, while working in this posture there are some health problems, while operating like this way the arm extension is always there. So, whether then to avoid this arm pains and etcetera, whether a special arm rest type of system can be developed and

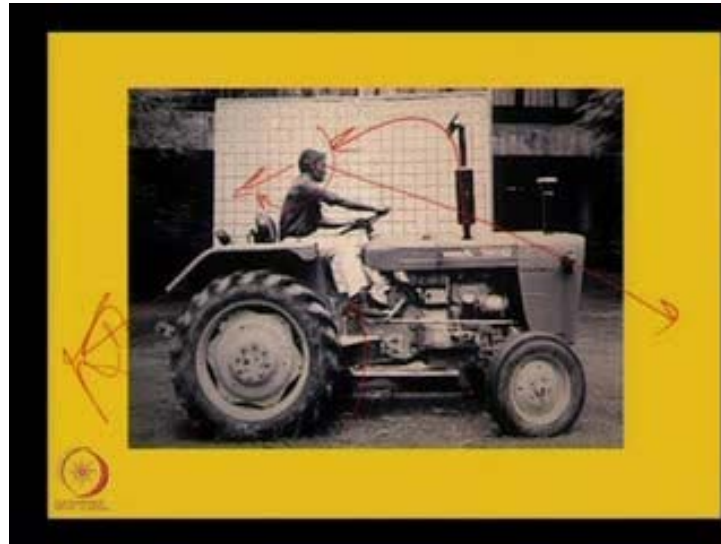
this is an idea. This one can give but how it is actually going to be implement that you have to make the product prototype test it. And then accordingly that a design solution can be given. So, the true design solution is safe work, safe and healthy work environment can be achieved.

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Like in this figure, the people are working in the open field. Now, it is simply said that their hair is covered with some clothes it gives padding, while carrying the material over head as well as it also gives a safe cover from the direct sun. Now, when they are using this as per their own understanding, so why not to make a design effort to make a specific matter for this, like if we can make a special helmet can we make something that maybe a moist cloth or something can be wrapped over the nose and mouth. So, that dust particles can be filtered the air can be filtered with that moist cloth and also you will feel a good air moist air in the direct sunlight. So, these type of design thoughts are there but we need to practice, we need to make it an effort has to be put for this.

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In this, what this tractor design and etcetera, there are some concern that visibility aspect for him, he has to look back for the work area, because this work is going on here, it will look back. so and in that this fume is coming to this nose and etcetera. So, what type of design development can be done, so that his movement will be easier and other vision etcetera would be better. So, the climbing and coming out would be easier.

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Now, in an individual work area, it seems only some of the area is the problem. Otherwise, it looks nice that it is like a figure it does not give an immediate problem.

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But the same work context in this figure with the presence of so many material and it makes a constrain workplace. So, the problem whatever is being faced here in this case it is some added concern.

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The office maintenance job, there is a huge scope for study and the problems here the health problems and etcetera, vision problem like this and safety the fall it may fall and so many other problems are there.

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This loom work is also problematic, due to the seating atmosphere sitting and then this back extended arm as well as there, you have to press this pedals and etcetera and then the overall the illumination level. All there are lot of environmental issues are there that affects their health and the safety of the workplaces, this needs to be considered to get a desired productivity.

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People are working in a constant standing posture a single task. So, no job rotation is allowed in this context. So, if the job rotation is done then some kind of relief is possible.

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The another work area that normally, when we talk about ergonomics and other big industrial work system, normally these things remain unnoticed work area.

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Another work area, now, we make quilt in the onset of winter season. So, it is for us, it is one side task, we are lucky but for these people for them it is a regular activity. So, the bending postures all these squatting and sit and then the needle, while operating the needle it may pierce their finger, so that a thimble type of guard and cover they normally they use. So, that while operating needles it will not create any injury problem to their finger, so a thimble type of cover they use and also here the and other direct environmental load is on them apart from these awkward posture task and etcetera. Now, what can be done, can we make a special work area for them but the task demands a moving at least at today's social requirement people prefer this thing to make their own quilt custom made. So, they call these people to their home but while working they normally do in the open space which constrains.

Design made for mostly men's use but women nowadays are also using this. So, there are some limitations but whether these limitations are concerned. Now, we cannot make a special equipment for male use or only for female use. Now, the common use we are concerning then what are the factors to be considered. So, **that** those men with their specification specialties and women with their other limitations and etcetera. Both the group can use that machine otherwise, what happens machine made for one group, if it does not match with other groups requirement, then there will be mismatch real body mismatch related health and safety problems.

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This is a quite known figure. The person here is making the sugarcane juice and also is working in making some other activities like cucumber cleaning selling and etcetera. Now, the case is that this is a special work area for him. So, the safety problem is also there health and hygiene is also another factor, for this person. So, they looking for hygienic aspect, so how we can make this in a small cubicle type of thing is it possible or what is necessary that study is required? we normally do all these things, we need to concern like in this aspect that how to design these issues.

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Another area is that cycle rickshaw and etcetera. The man powered vehicle the problem safety for driver, as well as the passengers need not necessarily to discuss each and every safety and health problems related to these rickshaws, I think all of us have used this and we know this matter the problems that is only for the passenger rickshaws.

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Now, a special type of band rickshaw has nowadays come in market. So, that it is for dual purpose for goods carriage, luggage carriage, as well as passengers carriage, both are possible still the human driven. But now, the same thing has been used for a power

driven equipment device. So, the speed and etcetera is vehicle, but here what happen while making is cheap. So, many health issues and some unsafe problem matters are still there.

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This is a special case, where we can say that a cycle rickshaw pulled by a person, but so many people are sitting it creates a another safety problem and while sitting like this way the posture being adapted, it also creates some health problem a musculoskeletal pain and etcetera so many other things.

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So, concerning these aspects at these are department of design, Indian institute of technology, Guwahati, some attempts were made. This is for that the person who is driving, he will get a cover also and the passenger, the seat length breadth, etcetera. All concerned. So, some kind of thought is being used here and these type of products are found in Guwahati road and others also, nowadays here now a attempt was made for a personal use, purpose so some work is going on but that a concerned effort is necessary to do for this. Now another issues.

This priest who does puja for this deities for this thing here the bending the posture, he adapts and etcetera it also creates pain. Now, whether we can call it as an occupation and now that is a debate, but a group of people do this type of activities and during specific seasons, their requirement becomes inevitable. So, at that time, the peak season what problem they face whether, we can make something for that they are also member of our society and this task required is for our purpose.

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It is a regular task for him, but for me it does not get that imprint. So, what type of development can be done here.

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This is an typical workstation in an office, all we want to have this and also some other but still here the problems is there. That in other way, though there is some muscular the muscle function is not there. Here, we do not need to do any physical job, physical requiring, physical power there are some concerns, where the main bread and butter is on the physical load pulling rickshaws the task pushing.

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Now, whether pulling and pushing we can design because everywhere this type of pulling pushing a cart is seen being used. One can see its design development, so that while moving this there should be some easiness undue problem will not be there.

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While pulling this load, now upper body is being used as a force applying component of the body. So, what is happen at this waist area, this belt it puts some mark, some study was done at National Institute of Health at Ahmedabad in their they found that this type of pulling, it creates it makes a unmark on the belly, on that at that abdomen area. So, these are the some of the aspects that one can consider, to avoid that what type of design can be done can we make a special harness type of thing at this moment, it is easy to say anything but we need to make it and practice it and see and after evaluation, we can say whether this design ideation is good.

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It is a common figure that if there soil digging is there then, this type of head carrying and unloading and while unloading to a truck or somewhere weight disposal, there is a slant, where they want to and then after dropping, they have to come down like this way. So, the figure itself says that it is not properly balanced, what could be done here, can we have a special design here. So, here what is happen a group of people here, they bring on their head and then here an exchange takes place. So, this people will only move within this region and then another group they move this region. So, while taking from one person to another here then, what would be the easiness of the movement that has to be concerned. Now, in this case, it is seen that this basket has 2 bamboo pipe rods. So, this portion gives easiness to hold, while shifting to another lady these developments they have done from their own understanding. So, when we make a load carrying device that to be carried over on a head then, such element we can be used for design development purpose.

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Here the equipment - the work equipment - it moves by self, but the controlling has to be done by person. And while controlling it says, now what are the postures they are feeling, and when it is being used, this floor becomes very slippery; what would be the wearing - foot wearing matter - **where** so that the person should not slip off on the floor.

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It requires a force as well as control, though some auto force, auto work machine or motor is applied here.

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In this case, the blade is moving automatically, but while holding it a static load is coming on the shoulder, because is a constant holding like this and in a to keep in a specific spacing, though the harness and etcetera are already designed, but still it imposes some problem so how further development can be done.

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This equipment an age-old equipment, still being used lot of development trials were made but still this product is being used. What are the benefits of this, why it is not

changed? These are the concerns that policymakers and management groups should consider this.

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This is another object, this broom for cleaning larger space, where the person is supposed to stand and work for this holding etcetera, it is decided that the so many development were done like this way it is bent like this way and then this. So, that one hand it can be hold and then another hand it can be kept here like this way. So, this bending etcetera, so this type of lot of developments and studies are already been done, but still people are using it. so, why a concerned effort is not there that we need to think, because it can be said that the development, whatever is being done the laboratory testing etcetera, it does not fit in the real field. So, then that link has to be maintained.

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This is a specific case, where the fish seller is used. So, the unsafe material sitting method and then the touching so what can be done here.

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Occupation that
does not concern
our sympathy

Occupation that does not concern our sympathy in fair and fair or somewhere else small markets these things are seen in daily basis. So, it is a pull pushed and it may be transported from one place to another place, but for this person it is a regular activity and it is for constant standing in an direct environmental load is to be there.

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Nurses, it is another big area for concern the health issues. So, the posture movement and etcetera, what they do.

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In a seashore, normally, this type of evening snacks making are there. Now, here, what is happening to protect from cold sea breeze, the cover is given here. So, such type of thing when in a winter season or when the wind is there a person drives scooter there some people they have a small ear cover kind of devices, they wear it. So, from all this things it comes we like or we want to see that all these issues, for the different activities occupations health problems are also there and safety problems are also there, like that here if the breeze here where then the this flame or from this stove, it can come to the body, so a cover is being used here to avoid that so this type of guards are a necessity. Now, people develop their own ideas and they implement it. Now, in this also this is the another figure, where the fire hazards are there this a common now, this photograph was taken from a backside of a very big party. Now, the other side of this figure the party is going on but those who are supplying the party material, the food but their work concern their these things, we can see it now many a things, if we are making for those who are attending the party, but behind whatever, who are making that we also need to concern that normally people say jokingly that in any restaurant. You go to the restaurant do not peep into their kitchen is it only a joke or it has some deep meaning in it. Then what can be done.

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This figure is in an open air under sun, the whole day this activity is going on then what type of remedy one can use it.

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This is a very typical one concern just, I would like to say that in this temple when people go inside after removing shoes and chappal, this person is sitting here with a small sprayer then he sprays, some water you can see here, he spray some water here with this machine and against that he takes some money as an entry fee, this is the matter the water bag here the connection is through this and this is that piston or a lever it looks very nice pilgrims come and go but this person sits there for longer time or considerable time. So, can we do something at this step. Now, this maybe only few temples but similar activities, now after seeing this similar matter can be used in some other areas then it can be a good development.

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People while cleaning large buildings hours' thus unsafe method, so till for that to prevent the fall this is the tying system is also there.

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Newspaper selling is another objective safe, unsafe in sun, rain perfect time he has to report to each and every household.

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Office area in the Calcutta metro, with this advertise paper cutting, it says that the metro railways, it is not safe nowadays, why because there are some other things, jokingly it is said that happy journey, call us after you reach like this whatever is mentioned here it may be a cartoon figure but it raises some concern.

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If a specific use that while chopping potato for frying, very fine particles. So, they use a rubbing device. Now, this type of a rubbing device is like this where the some of the scales out like this, so on this if you rub the potato, then the potato peels are come out

from other side. Now, that lady she is a professional potato peeler of a potato cutter, she goes most of the days for parties and is like that so she has developed her own technique, she put here and she sat on it and then she cleans like this, she cuts like this way, so she has developed her own, so means people always develop their own ideas to get safety as well as health concerns to be better.

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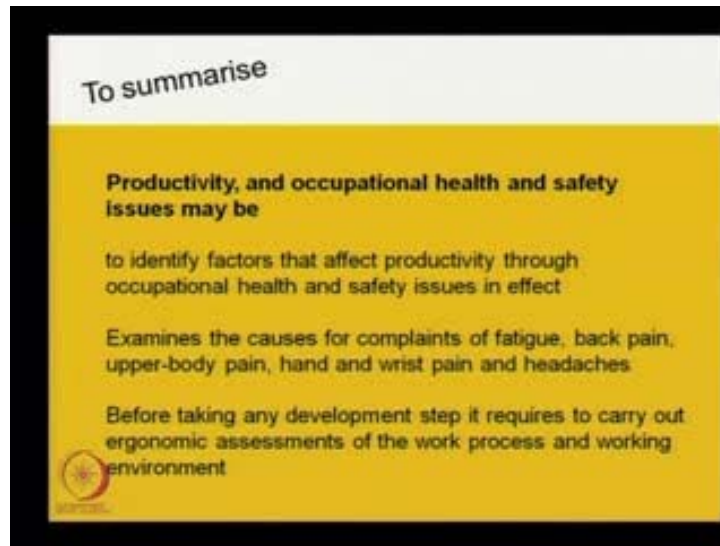
Now, this is another sell area is like that.

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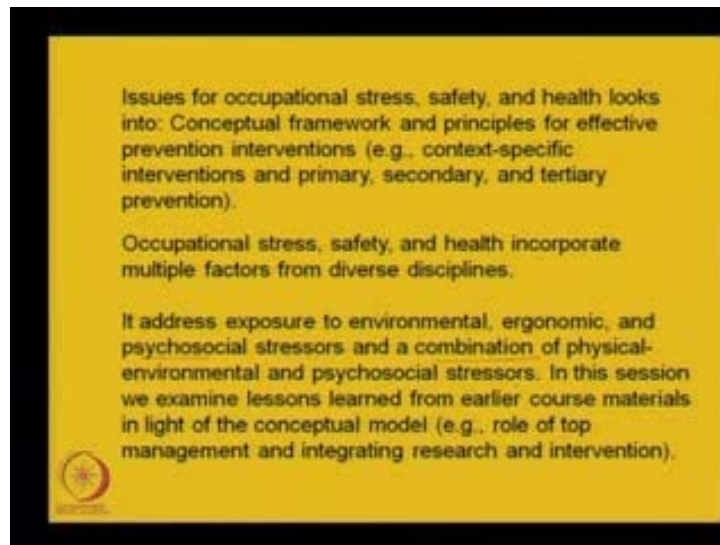
So, with it now this figure says, that the picture shown here is taken from an published source, that motivates us for developing context specific personal protective device design. Now, he is using that honey bee processing, so here honey that to protect his face a specific net is being designed scopes for development are plenty that need to be studied for betterment of the situation.

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To summarize productivity, and occupational health and safety issues may be, to identify factors that affect productivity through occupational health and safety issues in effect. Examines the causes for complaints of fatigue, back pain, upper-body pain, hand and wrist pain and headaches. Before taking any development step it requires to carry out ergonomic assessments of the work processes and working environment.

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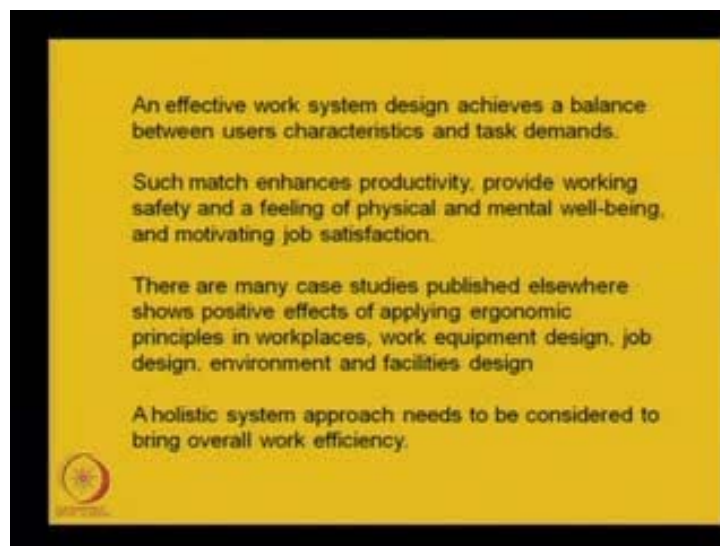
An issues for occupational stress, safety, and health looks into: conceptual framework and principles for effective prevention interventions as for example, context specific interventions and primary, secondary, and tertiary prevention. Occupational stress, safety, and health incorporate multiple factors from diverse disciplines. It addresses environmental, ergonomic, and psychological stressors and a combination of physical environmental and psychosocial stressors. In this session, we examine lessons learned from earlier course materials in light of the conceptual model, as for example role of top management and integrating research and interventions.

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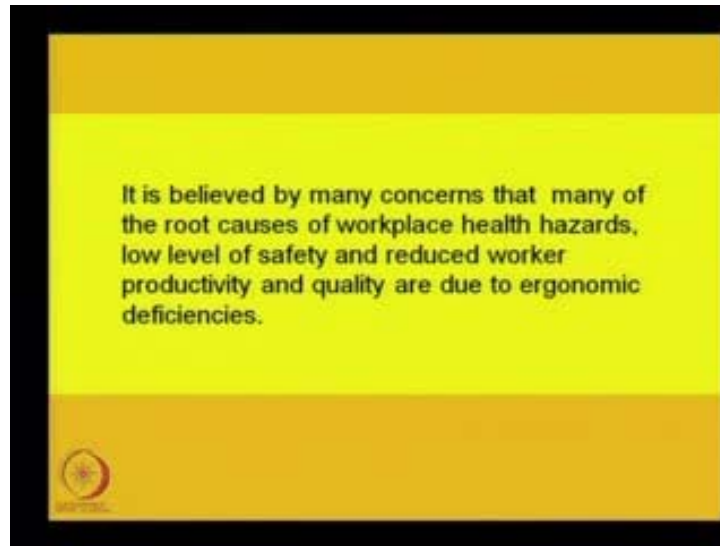
While talking about improving productivity and occupational health and safety OHS specially in developing countries like ours where a majority of work premises are unorganized and come under small scale and cottage industries. Some of the common features of these industries are improper workplace design, ill-structured jobs, mismatch between persons abilities and job demands, adverse environment, improper human machine system design and inappropriate management programs. This quite often leads to workplace hazards, poor worker, health mechanical equipment injuries, disabilities, and in turn this reduces work productivity and work or work quality and increases cost.

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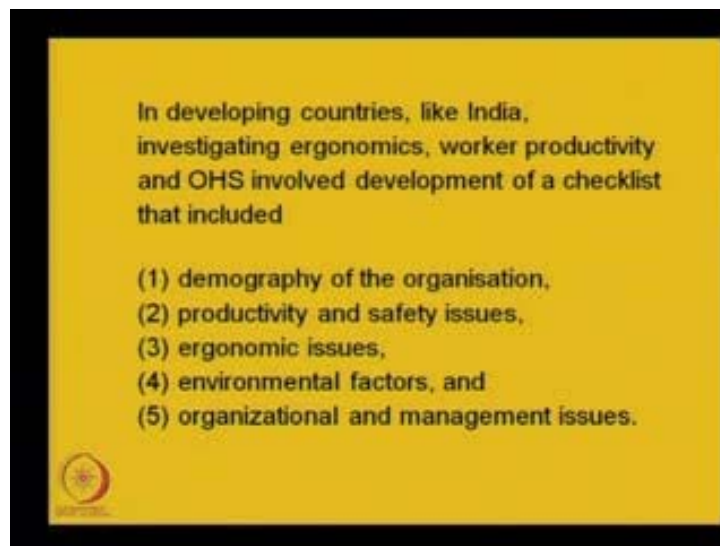
An effective work system design achieves a balance between users characteristics and task demands. Such match enhances productivity, provide working safety and a feel of physical and mental well-being, and motivating job satisfaction. There are many case studies published elsewhere shows positive effects of applying ergonomic principles in workplaces, work equipment design, job design, environment and facilities design. A holistic system approach needs to be considered to bring overall work efficiency.

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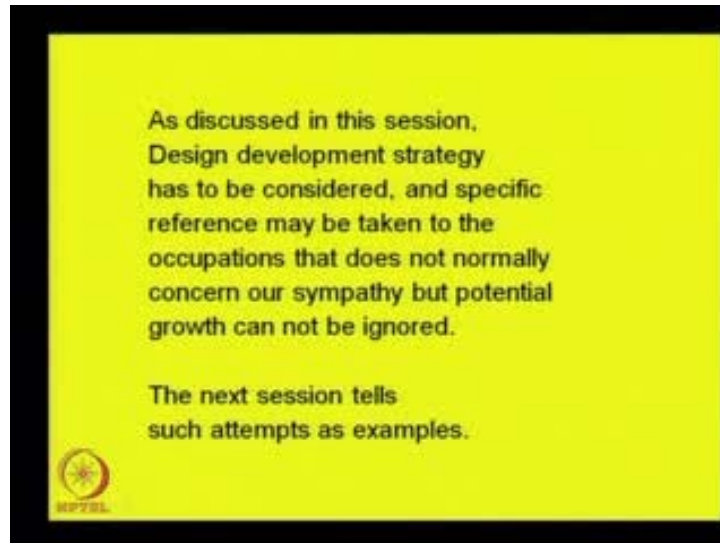
It is believed by many concerns that many of the root causes of the workplace health hazards, low level of safety and work reduced work productivity and quality are due to ergonomic deficiencies,

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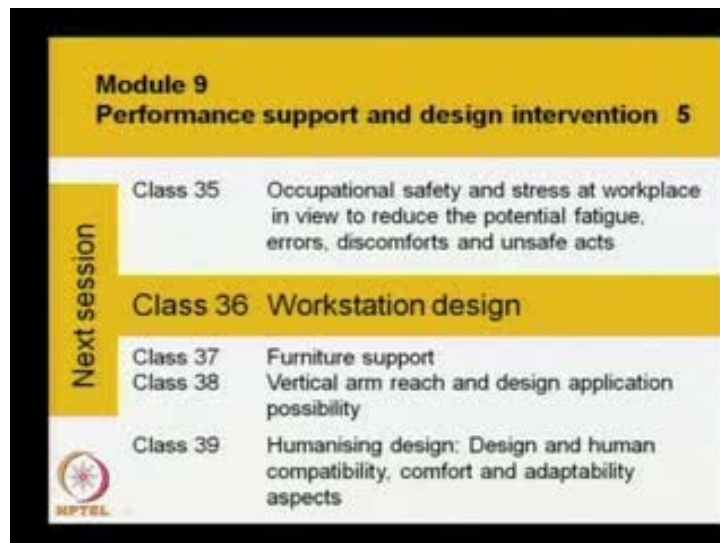
In developing countries, like India, the OHS are the checklist includes demography of the organization, productivity and safety issues, ergonomic issues, environmental factors, and organizational and management issues.

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As discussed in this session, design development strategy has to be considered, and specific reference may be taken to the occupations that does not normally concern our sympathy but potential growth cannot be ignored. The next session tells such attempts as examples.

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So the next session will concentrate on the class number 36 the workstation design

So this is our today's session so thank you very much