**NZQA**

**Approved**

Achievement standard: 91364 Version 3

Standard title: Demonstrate understanding of advanced concepts related to human factors in design

Level: 2

Credits: 4

Resource title: Working in the comfort zone

Resource reference: Generic Technology VP-2.11 v2

Vocational pathway: Primary Industries

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| Quality assurance status | These materials have been quality assured by NZQA.  NZQA Approved number A-A-02-2015-91364-02-8262 |
| Authenticity of evidence | Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material.  Using this assessment resource without modification may mean that learners’ work is not authentic. Assessors/ educators may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Vocational Pathway Assessment Resource

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Learner instructions

# Introduction

This assessment activity requires you to demonstrate your understanding of advanced concepts related to human factors in the design of an adjustable seat and the layout of hand controls for a machine used in the forestry industry, such as a skidder.

You are going to be assessed on how comprehensively you demonstrate understanding of advanced concepts related to human factors in design of an adjustable seat and the layout of hand controls for a machine used in the forestry industry, such as a skidder.

The following instructions provide you with a way to structure your work so you can demonstrate what you have learnt and achieve success in this standard.

Assessor/educator note: It is expected that the assessor/educator will read the learner instructions and modify them if necessary to suit their learners

# Task

You are to produce a report or presentation that demonstrates your understanding of advanced concepts related to human factors in design.

Investigate the ergonomic and aesthetic factors that influence the design of the adjustable seating and hand control layout for a machine used in the forestry industry, such as a skidder. You could choose to focus on other machines, for example a harvester, feller or buncher.

As you work, gather and analyse evidence for your report or presentation. You may work independently or in a group, but you must create your report or presentation on your own.

Decide on the format of your report or presentation. This could be a verbal presentation that includes a slideshow, a display board, a pamphlet, a video or a written report. Confirm this with your assessor/educator.

Create a report or presentation in which you do the following:

* Explain how statistics and probability are used to establish guiding ratios for anthropometric data (i.e. measurements of the human body) and how this and ergonomic aids are used:
  + for example you could explain statistical conclusions that can be drawn from anthropometric data and how this data is used to establish guiding ratios for developing an adjustable seat and determining the layout of hand controls for a machine used in the forestry industry, such as a skidder
  + you could also explain the importance of statistical information to a manufacturer developing the seat and hand controls of a forestry machine that will be used by diverse groups of the population.
* Explain how anthropometric data is gathered:
  + for example you could explain how to gather data from reference books and databases and how to generate data from surveys or by measuring a range of users or similar machines.
* Explain how this data and ergonomic aids are used in designing an adjustable seat and determining the layout of hand controls for a forestry machine:
  + for example you could explain how ergonomes could be used when designing the seat dimensions and adjustability and the layout and functions of hand controls
  + you could explain the importance of access to local data, drawn from local or similar populations, to machine designers.
* Discuss the relationship between anthropometric data, user preference and ergonomic fit, with particular reference to a particular combination of seat design and hand control layout:
  + you could discuss how these factors collectively inform the particular seat design and hand control layout you selected, how they interact when design decisions are being prioritised and how and why they are seen in the final design and layout.
* Explain how customisation allows for user preference and enables ergonomic fit:
  + you could explain how most individual users in the target group would find a customised fit within the range of adjustability offered by the seat design and hand control layout.
* Discuss the customisation undertaken to address user preference and enable ergonomic fit in the seat design and hand control layout:
  + for example you could explain how this customisation could be undertaken using ergonomes, anthropometric and user-preference data, and functional models
  + you could explain how customisation of a seat and hand control layout could be carried out for a small group of forestry workers to allow ergonomic fit
  + you could compare and contrast the needs of the machine user and the manufacturer (in terms of cost, for example) and the ergonomic requirement to create a seat and hand control layout that could help prevent injury
  + you could consider a particular seat design and hand control layout for which you know the customisation details and explain what data influenced the customisation in terms of shape, colour and materials. Consider what was achieved and what was rejected as too expensive or unsuitable.

Include evidence such as photographs, diagrams and statistical data to support your explanations and discussion. Ensure that sources are fully referenced.

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Assessor/Educator guidelines

# Introduction

The following guidelines are supplied to enable assessors/educators to carry out valid and consistent assessment using this internal assessment resource.

As with all assessment resources, education providers will need to follow their own quality control processes. Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material. Using this assessment resource without modification may mean that learners' work is not authentic. The assessor/educator may need to change figures, measurements or data sources or set a different context or topic. Assessors/educators need to consider the local context in which learning is taking place and its relevance for learners.

Assessors/educators need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing learners against it.

# Context/setting

This activity requires learners to demonstrate comprehensive understanding of advanced concepts related to human factors that need to be considered in the design of an adjustable seat and the layout of hand controls for a machine used in the forestry industry, such as a skidder.

# Conditions

Learners could gather and analyse their evidence independently or in groups, but they must present their individual understandings.

# Resource requirements

Learners may require access to a library, computers and information technologies.

Learners may also require access to a local manufacturer and to examples of forestry machines designed to include an adjustable seat. Access to a machine for which learners can provide details of how the seat design and hand control layout was customised would also be useful.

Useful resources include:

Tilley, A.R. & Dreyfuss, H. (2002), *The Measure of Man and Woman: Human factors in design,* John Wiley & Sons Inc., USA

Pheasant, S. (2006), *Bodyspace: Anthropometry, Ergonomics and the Design of Work,* CRC Press

Miller, L. & Gariepy C. *Heavy Mobile Equipment – Ergonomics and the Prevention of Musculoskeletal Injuries*, EWI Works International Inc.: <http://ewiworks.com/pdfs/New_Heavy_Mobile_Equipment-2.pdf>

*The Haworth Ergonomic Seating Guide Handbook*: <http://www.haworth.com/docs/default-source/documents-files-very-task/ergonomic_seating_guide_handbook-pdf-13337.pdf>

Sears Seating: [www.searsseating.com/technology](http://www.searsseating.com/technology)

Technology Online glossary: <http://technology.tki.org.nz/Glossary>

**Additional information**

None.

## Other possible contexts for this vocational pathway

Demonstrating understanding of advanced concepts related to human factors in design of:

* functional hand controls in machinery for farming or horticulture
* planting boxes with a harness for use in the forestry industry.

# Assessment schedule: Generic Technology 91364 – Working in the comfort zone

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner demonstrates understanding of advanced concepts related to human factors in design by:   * explaining how statistics and probability are used to establish guiding ratios for anthropometric data and how this and ergonomic aids are used   For example:  The learner refers to sampling, measurements and their relationships, graphs, percentiles, means, standard deviations, raw data, normal distribution, cut off points, tail ends, design adjustability, customer satisfaction and population types.  The learner explains statistical conclusions that can be drawn from anthropometric data (e.g. arm reach, elbow rest height, stomach breadth, thigh clearance) and how these and ergonomic aids (e.g. computer simulated human manikins) are used to establish guiding ratios for seat design and hand control layout used in machinery, with reference to skidders (or graders, loaders, harvesters, bulldozers).   * explaining how customisation allows for user preference and enables ergonomic fit   For example:  The learner explains how customisation of a seat could be carried out to allow ergonomic fit for forestry workers. The learner explains how functional modelling can be used as a tool to aid product customisation.  The learner explains that most individual users in the target group would find a customised fit within the range of adjustability offered by the seat design and hand control layout.  *The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates in-depth understanding of advanced concepts related to human factors in design by:   * explaining how anthropometric data is gathered and ergonomic aids are used when designing forestry machinery   For example:  The learner explains data gathering and analysis techniques and refers to sampling, measurements and their relationships, graphs, percentiles, means, standard deviations, raw data, normal distribution, cut off points, tail ends, design adjustability, customer satisfaction and population types.  The learner explains how anthropometric data is retrieved from such places as existing databases and reference books, and generated from surveys, sensory analysis, physical measurement of a range of users (e.g. arm reach, elbow rest height, stomach breadth, thigh clearance) and measurement of existing machines.  The learner explains how statistical conclusions drawn from this anthropometric data are used with ergonomic aids.  The learner gives details of how and why ergonomes, anthropometric/human design programs and ergonomic design templates are used to establish guiding ratios for seat design and hand control layout used in skidders (or graders, loaders, harvesters, bulldozers).   * explaining how customisation is undertaken to address user preference and enable the ergonomic fit of a seat and hand control layout   For example:  The learner explains the issues to be considered when developing questionnaires, using models and interacting with clients to ensure quality feedback on ergonomic requirements of seat and hand control layout for forestry machinery.  The learner explains the range of adjustability within the seat design and hand control layout and how individual users would find customised fit (e.g. for vision, reach of controls, comfort). They explain how adjustability levels may not suit the entire user group and the cost/benefit and feasibility of a one-off seat design for a single user.  *The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates comprehensive understanding of advanced concepts related to human factors in design by:   * discussing the relationship between anthropometric data, user preference and ergonomic fit in a seat and hand control layout   For example:  The learner explains data gathering and analysis techniques and refers to sampling, measurements and their relationships, graphs, percentiles, means, standard deviations, raw data, normal distribution, cut off points, tail ends, design adjustability, customer satisfaction and population types.  The learner explains how anthropometric data is retrieved from such places as existing databases and reference books, and generated from surveys, sensory analysis, physical measurement of a range of users (e.g. arm reach, elbow rest height, stomach breadth, thigh clearance) and measurement of existing machines.  The learner explains how statistical conclusions drawn from this anthropometric data are used with ergonomic aids. The learner gives details of how and why ergonomes, anthropometric/human design programs and ergonomic design templates are used to establish guiding ratios for seat design and hand control layout used in skidders (or graders, loaders, harvesters, bulldozers).  The learner discusses how anthropometric data, user preference and ergonomic fit inform the design collectively and how the interaction between these factors informs design priorities.  They discuss how and why these priorities affect design decisions and are seen in the completed product, using existing machine designs to illustrate prioritised design decisions.   * discussing the customisation undertaken to address user preference and obtain ergonomic fit in a product   For example:  The learner compares and contrasts what the user group’s needs and preferences were and the ergonomic requirements for the seat and hand control layout.  The learner discusses what data was used and how this influenced the customisation of the design of the seat and the hand control layout in terms of such things as shape, size, colour, positioning and materials.  They also discuss what design ideas were discarded during the design and production process and why.  *The above expected learner responses are indicative only and relate to just part of what is required.* |

Final grades will be decided using professional judgement based on an examination of the evidence provided against the criteria in the Achievement Standard. Judgements should be holistic, rather than based on a checklist approach.