**Unit plan: New opportunities for protective wear**

**Overview**

In this unit, students will consider the performance properties of new stab and flame-resistant fabric and design protective wear for new market opportunities.

**Purpose**

To investigate the development of this new material, to understand the societal influences and impacts, develop knowledge of its properties and consider possible future uses and markets.

**Background**

***Suggestions for a scenario***

A new stab and flame-resistant fabric developed in New Zealand by AgResearch has potential to widen the use of protective garments. Explore the background and properties of this new material and identify a potential use and target market. Develop a conceptual design for a garment fit for the purpose and present a convincing proposal to the target market.

***Where's the biotechnology?***

Wool is a natural fibre obtained from animals – it has a unique structure and properties. It is a key component of this new stab and flame-resistant material. Understanding wool’s characteristics has enabled scientists to develop new processes and materials to widen the applications for wool and meet consumer demands for new materials that meet changing lifestyle needs.

**Curriculum focus – technology**

***Technological practice***

Students will investigate the development of this new material. They will explore other possible uses of the material and consider consumer needs and market demand before generating specifications and design ideas to meet the identified need or opportunity. They will prepare and present a design proposal to convince an audience of the need.

***Technological knowledge***

Students will develop their understanding of the structure and properties of wool, how they can be manipulated or enhanced and how this relates to suitability for particular purposes and garments. They will appreciate the integral role of testing and modelling in developing new materials and providing evidence of performance to inform decisions about ongoing development and potential uses and markets.

***Nature of technology***

Students will develop an appreciation of the societal influences and impacts of this new material. They will develop an understanding of how ideas for new technologies and consumer acceptance of them changes over time in response to many factors. They will consider the potential impacts on society and other possible uses of the new stab and flame-resistant material.

***Focus of skill and strategy***

This unit provides an opportunity for students to engage with a current technological development in New Zealand. The focus of student learning is on developing their understanding of factors that influence the development of new technologies and thinking critically about the potential impacts on different groups of people.

Students will apply their knowledge to developing a presentation that will communicate the potential of this new material to meet a specific community need or opportunity and engage a specific market group.

**Health and safety**

Students need to be made aware of ethical and privacy issues in carrying out research using interviews and surveys.

| **Suggested learning intentions** | **Suggested learning experiences** | **Possible teaching/assessment activities** |
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| **Introduction** |
| Understand that materials have properties that make them suitable for particular products and purposes.Understand that products are fit for purpose in terms of time and context. | Show or get students to research images of body armour – both historical and modern examples, such as Police stab-proof and bullet-proof vests, shields and armour used by ancient civilisations.Allocate 2 images to each group of students – 1 of a current garment or item and 1 of an older one. Have students discuss and answer the following questions for each image and groups report back key points to the class:* What materials are used?
* What makes them stab-proof or bullet-proof?
* How well do they serve their purpose and why?
* How comfortable would they be to wear and why?
* How have they changed over time and why?

If possible, have samples of some materials that may have been used such as Kevlar or similar fabric, wood, leather and iron so students can see and feel the material and imagine how it might be shaped into products, how much protection it would offer and how comfortable it would be to wear. Include actual garments if possible. | Students list the advantages and disadvantages of the items below their images and display these on the classroom wall. |
| **Introduce the scenario** |
| Understand how the idea for this technology developed, the influences and current and potential impacts on society.Understand the scenario and develop ideas to address the task. | Show the video clip [Advantages of new stab and flame-resistant fabric](https://www.sciencelearn.org.nz/videos/467-advantages-of-new-stab-and-flame-resistant-fabric). It shows the new material and compares it with Kevlar – a synthetic material commonly used in existing protective garments.**Scenario:** A new stab and flame-resistant fabric developed in New Zealand by AgResearch has potential to widen the use of protective garments. Explore the background and properties of this new material and identify a potential use and target market. Develop a conceptual design for a garment fit for the purpose and present a convincing proposal to the target market. **Brainstorm:** Who could benefit from this material? What possible uses could it have?Students read the article [Developing new stab and flame-resistant fabric](https://www.sciencelearn.org.nz/resources/873-developing-new-stab-and-flame-resistant-fabric).**Possible discussion questions:** * What factors influenced the development of this material?
* What are the advantages of this material?
* What are the disadvantages?
* What are possible uses and markets?
 | After viewing the video clip students record the advantages of the new stab and flame-resistant fabric. Share with the class and add others’ ideas to their list.Make a class or individual record of the brainstorm to be added to later.Have students record their answers to the questions then share in pairs or groups and add to their answers.  |
| **Developing knowledge and skill** |
| Understand the structure and properties of wool and how this relates to its end uses.Understand how wool and VectranTM are combined and formed into the new material.Understand how the material formation and fibre properties create the performance properties of the material.Understand the fabric’s level of protection and how this can be manipulated. Understand that outcomes often require a resolution between their form and function to make them fit for purpose.Understand that consumer needs and wants are important considerations in developing new products. | Have students complete the activity [Exploring wool fibre properties](https://www.sciencelearn.org.nz/resources/879-exploring-wool-fibre-properties).To learn more about the new fabric and its properties, have students read the article [New stab and flame-resistant fabric](https://www.sciencelearn.org.nz/resources/872-new-stab-and-flame-resistant-fabric) and view the video clips:* [Making new stab and flame-resistant fabric](https://www.sciencelearn.org.nz/videos/468-making-stab-and-flame-resistant-fabric)
* [Demonstrating flame resistance](https://www.sciencelearn.org.nz/videos/456-demonstrating-flame-resistance)
* [Testing stab resistance](https://www.sciencelearn.org.nz/videos/455-testing-stab-resistance)

**Research protective wear:** Find out about the range of existing activities and roles that use it – see questions below.**Guest speaker:** If possible invite a guest speaker – someone who wears protective garments in their work, sporting or leisure activities. Ask them to talk about the nature of the activities and the nature and importance of the protective garments they wear. Have students prepare questions to ask the speaker to learn more about protective wear and its current uses. Questions could include: * Why do they need protective garments?
* What are the garments made from?
* What are their design features?
* How does it affect their work?
* What do they think about wearing them, their effectiveness and limitations?
* Are there any regulations or standards that apply to manufacturing or use/wearing of the items?
 | In groups, students record key points about the fabric formation and properties that contribute to its protective and comfort qualities – information that can be used to support their proposal.Students research/record properties and other uses of VectranTM fibre.Students record key points from research and/or guest speaker.  |
| **Design a new protective garment** |
| Understand that needs and opportunities for new technologies vary over time and between cultures and geographical locations. | This task could be completed in groups or individually:* Consider ideas from previous brainstorm of uses of the new material. Build on this, thinking more broadly of activities and roles that offer possible opportunities and needs for protection. Do a PMI to evaluate some of the key ideas and decide which you consider would have the most consumer demand.
* Investigate clothing and protection measures currently used for this purpose or role. Analyse design features, materials used, their properties and fitness for purpose or effectiveness.
* Investigate the nature of the activity to find out what sort of protection is needed. Interview a person involved in this activity or, if practical, survey 10–20 people involved to find out more about the activity, the user needs and wants, the protection required and to determine the likely demand for such a garment. If possible, consider what demand there may be nationally or even globally.
* Generate specifications the garment would need to meet in order to provide an appropriate level of protection as well as meeting the needs and wants of the user.
* Design a garment that takes account of the specifications and research findings. Present initial ideas to your group. Take account of their feedback and refine your design. If possible, present your conceptual design to someone involved in the activity and use their feedback to help you finalise your design and prepare supporting information to convince a manufacturer or potential end-users such a garment would be successful in the market.
* Prepare and present a design proposal and supporting material using a suitable format such as PowerPoint, digital storytelling, chart or poster.
 | Brainstorm and PMI. Discuss protocols and ethical considerations in interviewing and surveying – establish guidelines. Record specifications. |
| **Present the design proposal** |
| Understand that new technologies are not automatically accepted by society and that a range of factors can influence acceptance.  | Groups/individuals present their proposals to the class. Include stakeholders of potential user groups in the audience if possible. | At the conclusion of the presentations, invite feedback from invited stakeholders if present. Students discuss in groups which design proposal they think is most likely to be successful in the current market and give reasons. |