Biological education for the 21st century: educating the next generation for tomorrow's society

Biološka izobrazba za 21. stoletje: izobraževanje nove generacije za družbo prihodnosti

Bioscience and society

2 October 2009

Professor Derek Bell

The Wellcome Trust

London UK

d.bell@wellcome.ac.uk

EDUCATING THE NEXT GENERATION:
stimulating interest, curiosity and challenge

Two questions:

What can biological education contribute to the general education of young people in 21st Century?

Kaj lahko biološko izobraževanje prispeva k splošni izobrazbi mladih v 21. stoletju?

How might we approach biological education in order to meet the future demands of society?

Kako naj zasnujemo biološko izobraževanje, da bo ustrezalo prihodnjim potrebam družbe?

Major challenges in the world today

- **managing the impacts of environmental and climate change;**

  nadzor vplivov sprememb v okolju in podnebju

- **ensuring the health and well-being (economic and social) of the world's populations;**

  zagotavljanje zdravja in blagostanja (ekonomskega in socialnega) svetovne populacije

- **maintaining biodiversity and the sustainability of resources and the environment;**

  vzdrževanje biodiverzitete in trajnostne rabe virov in okolja

Major challenges in the world today

- **providing adequate food and water supplies worldwide;**

  zagotavljanje zadostnih zalog hrane in vode v svetovnem merilu

- **securing global stability and peace.**

  varovanje globalne stabilnosti in miru

Teaching **about** biology and **through** biology

- **successful learners who enjoy learning, make progress and achieve;**

  uspešni učenci, ki uživajo v učenju, napredovanju in dosežkih

- **confident individuals who are able to live safe, healthy and fulfilling lives;**

  samozavestni posamezniki, ki so sposobni živeti varno, zdravo in polno življenje

- **responsible citizens who make a positive contribution to society.**

  odgovorni državljani, ki pozitivno prispevajo k družbi

(QCA 2007)

Question 2:

What can biological education contribute to the general education of young people in 21st Century?

Kaj lahko biološko izobraževanje prispeva k splošni izobrazbi mladih v 21. stoletju?

How might we approach biological education in order to meet the future demands of society?

Kako naj zasnujemo biološko izobraževanje, da bo ustrezalo prihodnjim potrebam družbe?

Meeting future demands of society

‘..the success of R&D is critically dependent upon the availability and talent of scientists and engineers.’

"... uspeh R&R je kritično odvisen od dostopnosti in nadarjenosti znanstvenikov in inženirjev“

Roberts Report 2002

‘In an open democracy, scientific endeavour has to secure broad-based social acceptance if it is to flourish.’

"V odprti demokraciji si mora znanost prizadevati zagotoviti si široko sprejetost v družbi, da bi lahko uspešno delovala.“

The Royal Society 2004

Two key principles

- **Bioscience education depends on enthusiastic teachers who are up to date and able to engage their students in developing an appreciation of the discipline.**

Izobraževanje v bioznanostih temelji na navdušenih učiteljih, ki sledijo napredku in lahko popeljejo svoje učence do dobrega razumevanja področja

- **Bioscience education should enthuse and engage young people with curiosity, awe and wonder of the world in which they live.**

Izobraževanje v bioznanostih mora navduševati in spodbujati mlade k radovednosti, spoštovanju in občudovanju sveta, v katerem živijo

Young people should be able to:

- **understand and adopt scientific methodologies;**

  razumevanje in sprejetje znanstvenih metodologij

- **apply knowledge and skills across subjects;**

  uporabo znanja in veščin pri različnih predmetih

- **make judgements about the quality of scientific evidence;**

  presoditi kakovost znanstvenih dokazov

Young people should be able to:

- **apply biology to everyday life;**

  uporabo znanja biologije v vsakodnevnem življenju

- **make sense of, and form opinions about, science issues in the media;**

  razumeti in oblikovati lastno mnenje o znanstvenih temah v medijih

- **discuss ethical issues arising from biological science.**

  razpravljati o etičnih vprašanjih, ki izvirajo iz bioloških znanosti

Biological knowledge:

- **The nature of biology**
- **The chemicals of life**
- **The structure and function of cells**
- **Biotechnology and genetic modification**
- **Energy transfer and nutrition**
- **Food production**
- **Homeostasis and control within organisms**

- *Narava biologije*
- *Molekule življenja*
- *Struktura in delovanje celic*
- *Biotehnologija in genske spremembe*
- *Kroženje energije in prehrana*
- *Pridelava hrane*
- *Homeostaza in nadzor notranjega okolja organizmov*

More Biological knowledge:

• **Infection and defence against disease**	• *Okužbe in obramba proti boleznim*
• **The nervous system and behaviour**	• *Živčni sistem in vedenje*
• **Heredity and genetics**	• *Dednost in genetika*
• **Reproduction, growth and development**	• *Razmnoževanje, rast in razvoj*
• **Ecology and the environment**	• *Ekologija in okolje*
• **Biodiversity and taxonomy**	• *Biodiverziteta in taksonomija*
• **Natural selection, artificial selection and evolution**	• *Naravni izbor, umetni izbor in evolucija*

Importance of children's ideas

- *…***it is as important in teaching and curriculum development to consider and understand children's own ideas as it is to give a clear presentation of the conventional scientific theories.**

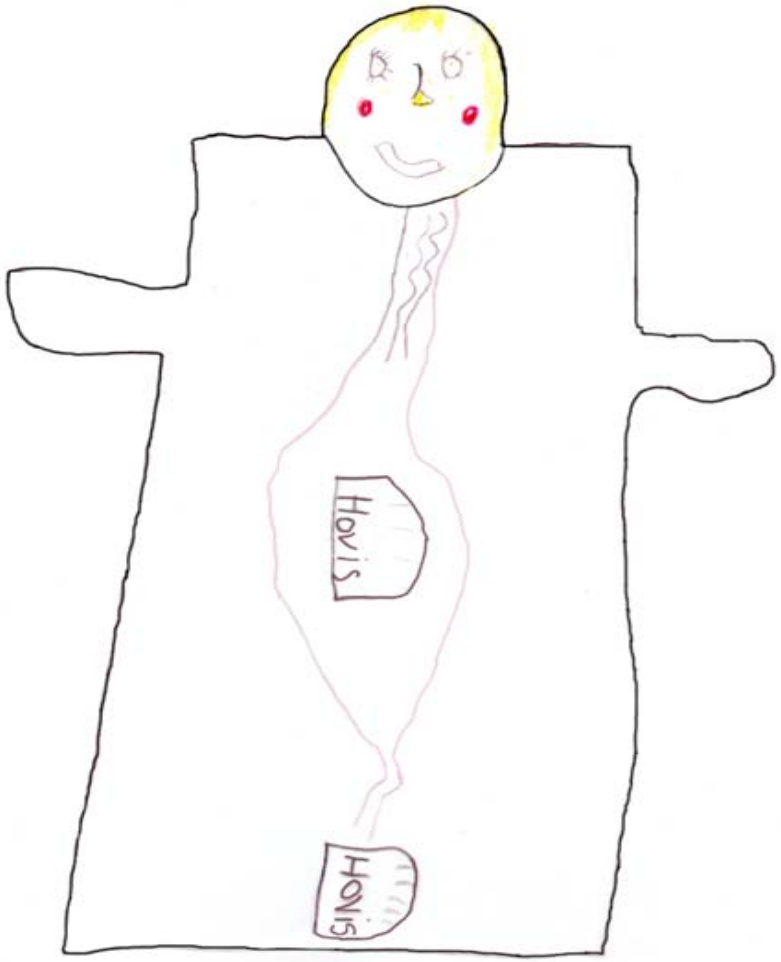
Driver 1983

… v poučevanju in oblikovanju učnega načrta je enako pomembno upoštevati in razumeti lastne predstave otrok, kot podati jasno predstavitev uveljavljenih znanstvenih teorij

What do you think happens to the food inside your body?

What do you think happens to the food inside your body?

What do you think happens to the food inside your body?



Developing children's ideas

- **enable children to test their own ideas through practical hands-on activities and investigations;**

omogočijo otrokom preizkušanje njihovih lastnih idej skozi praktične, lastnoročne aktivnosti in raziskovanje

- **encourage generalization from one context to another by experiencing and considering other instances of phenomena;**

spodbudijo posploševanje iz enega konteksta na drugega z izkušnjami in preučevanjem drugih primerov pojava

Developing children's ideas

- **discuss the words children use to describe and explain events by exploring with them their use and understanding of both 'scientific' and 'non-scientific' language;**

razpravljamo o besedah, ki jih otroci uporabljajo za opisovanje in razlaganje dogodkov, z vzajemnim raziskovanjem njihove uporabe besed in razumevanjem tako "znanstvenega" kot "neznanstvenega" jezika

- **extend the range of evidence available to test their ideas often trying to find ways of making the invisible visible, through the use, for example, of models and simulations;**

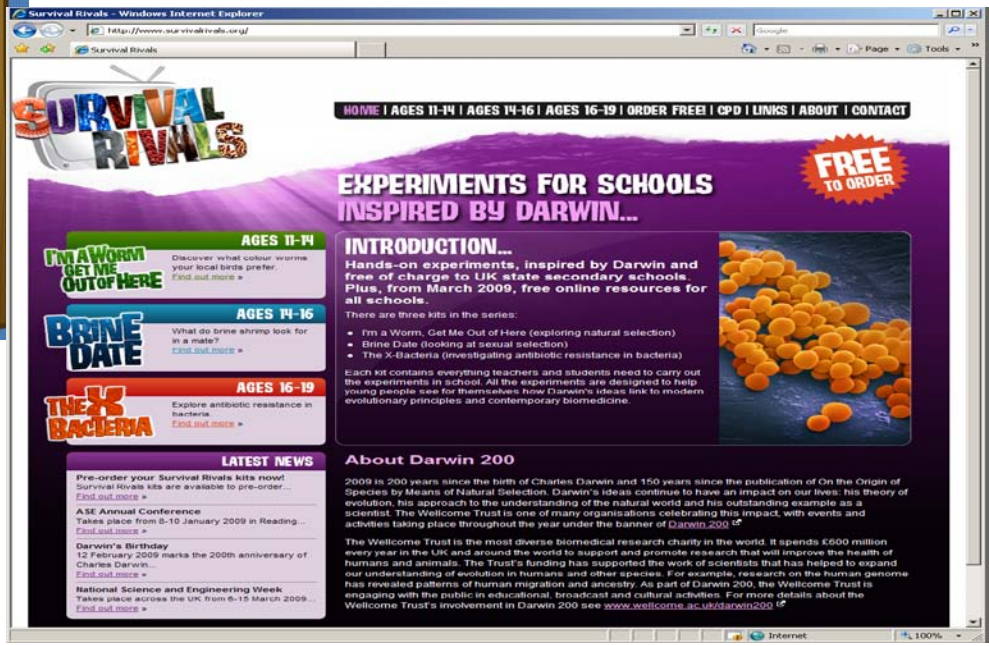
razširimo razpon dostopnih dokazov za preizkušanje njihovih idej, pogosto z iskanjem načinov kako nevidno narediti vidno, na primer z uporabo modelov in simulacij

- **help children to communicate their ideas, allowing them to explain and challenge each others ideas.**

pomagamo otrokom predstaviti njihove ideje, jih razložiti in preizkušati ideje drugih

Going beyond the classroom: Darwin inspired activities

www.greatplanthunt.org



www.survivalrivals.org

Assessing student progress

- **There is a body of firm evidence that formative assessment is an essential feature of classroom work and that development of it can raise standards.**

Black and Wiliam 1998

Obstajajo trdni dokazi, da je sprotno preverjanje znanja ključna značilnost dela v učilnici in njegov razvoj lahko zviša standard [pouka]

Looking forward

- **build a curriculum which allows for flexibility and creativity drawing on a wide range of experiences both inside and outside the classroom through both formal and informal education;**

razvijemo učni načrt, ki dovoljuje prožnost in ustvarjalnost na podlagi širokega razpona izkušenj, tako iz učilnice kot zunaj nje, s formalnim in neformalnim izobraževanjem

- **keep expectations high recognising that shifting the balance of the curriculum should not result in a decrease in quality or a reduction in rigor.**

ohranimo visoka pričakovanja, tako da s spreminjanjem ravnovesja v učnem načrtu ne znižamo kakovosti ali zmanjšamo natančnosti

Looking forward

- **work together across all sectors and draw on the expertise of teachers, subject specialists, politicians, industrialists and the young people themselves.**

delujemo povezano v vseh sektorjih in uporabimo strokovno znanje učiteljev, strokovnjakov za posamezna področja, politikov, gospodarstvenikov in mladih samih

Engaging learners: at the heart of what we do