IPT 2.0 is Here; ITS is MIA:
Changes to the Senior Syllabus

QSITE AGM Keynote:

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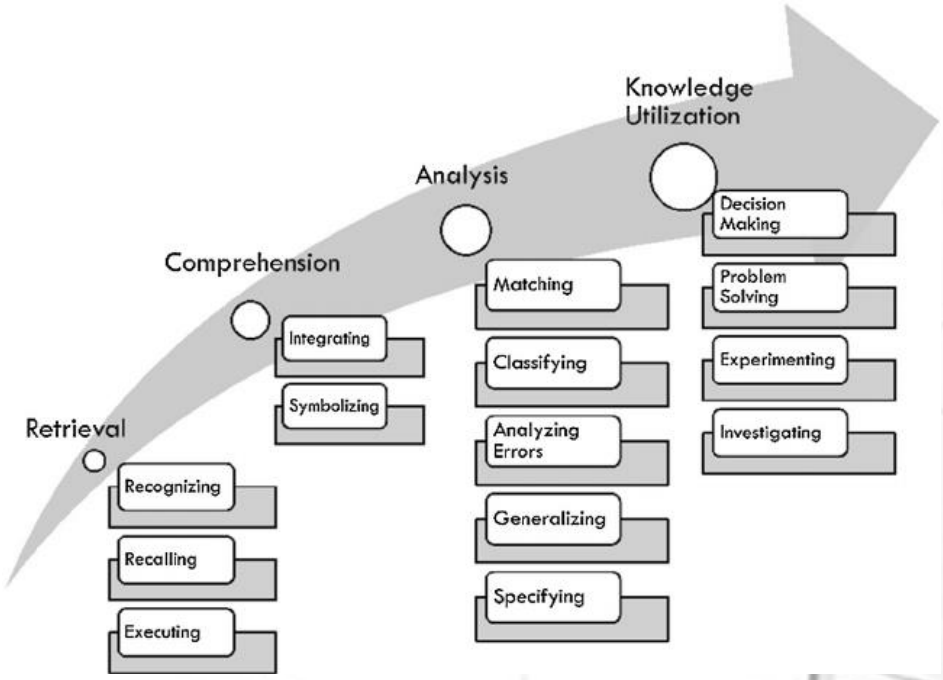
Outline:

- Overview of the QCAA DIGITAL SOLUTIONS (Draft 2), including
  - The content of the 4 Units & some possible assessment issues
- The DESIGN Subject – a very cursory overview
- What's missing; what's needed; what's coming
- The Significance of Job Clusters to IT Education
- What can you do?

Overview of Process and Implementation schedule:

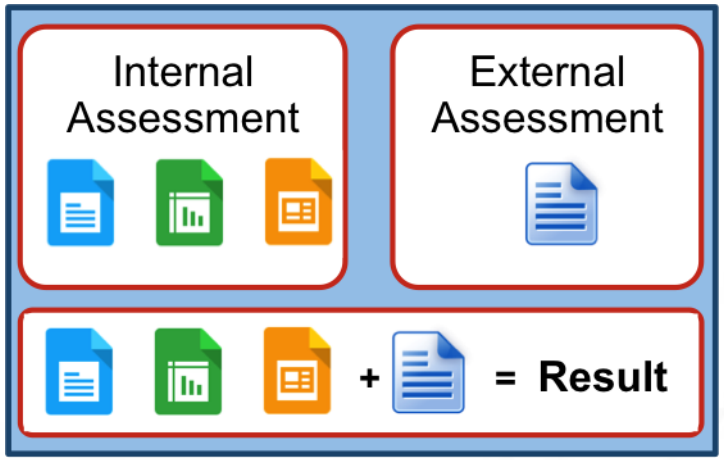
- Biggest change @ 11/12 in 40 years; start with Yr 11 in 2019
- Mazano Taxonomy
- Learning Area Reference Groups (LARG)
- Expert Writing Team (EWT)
  - headed by QCAA Review Officers
- Technologies KLA Subjects:
  - Aerospace Systems
  - Engineering
  - Food & Nutrition
  - Design – *a replacement for Graphics, Technology Studies & ITS?*
  - Digital Solutions – *a Computer Science course – IPT 2.0?*

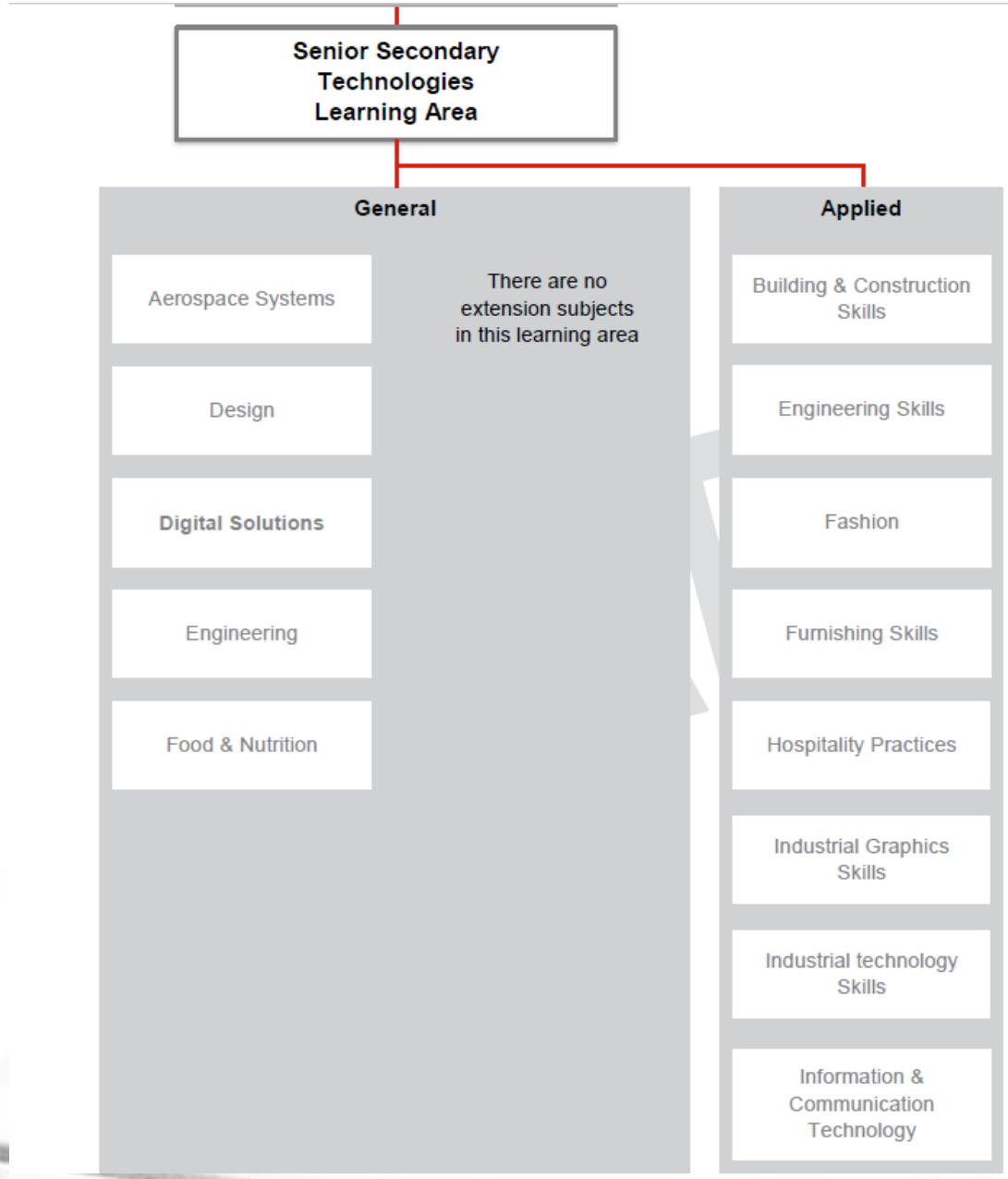


Syllabus development and engagement

- Authority syllabuses will be redeveloped in 2016 for publication in 2017/2018.
- Syllabuses will define how internal (school-based assessments) will be combined with external assessment to produce a subject result.

- Technologies:
- Teachers have had one opportunity in 2016 to provide feedback on syllabuses as they are developed, and will have 1-2 in early 2017.




Senior Secondary Technologies Learning Area
General
Aerospace Systems
Design
Digital Solutions
Engineering
Food & Nutrition
There are no extension subjects in this learning area
Applied
Building & Construction Skills
Engineering Skills
Fashion
Furnishing Skills
Hospitality Practices
Industrial Graphics Skills
Industrial technology Skills
Information & Communication Technology

Digital Solutions

Unit 1
Creative coding

Key concepts:

- Specification
- Data
- Algorithms
- Implementation
- Interactions
- Impacts
- Project management
- Communication

Assessment

Formative internal assessment/s

Unit 2
Application and data solutions

Key concepts:

- Specification
- Abstraction
- Data collection
- Data representation
- Data interpretation
- Algorithms
- Implementation
- Digital systems
- Interactions
- Impacts
- Project management
- Communication

Assessment

Formative internal assessment/s

Unit 3
Digital innovation

Key concepts:

- Specification
- Abstraction
- Data collection
- Data representation
- Data interpretation
- Algorithms
- Implementation
- Digital systems
- Interactions
- Impacts
- Project management
- Communication

Assessment

Summative internal assessment 1:
Technical proposal (15%)

Summative internal assessment 2:
Digital solution (35%)

Unit 4
Digital impacts

Key concepts:

- Specification
- Abstraction
- Data
- Algorithms
- Implementation
- Digital systems
- Interactions
- Impacts
- Communication

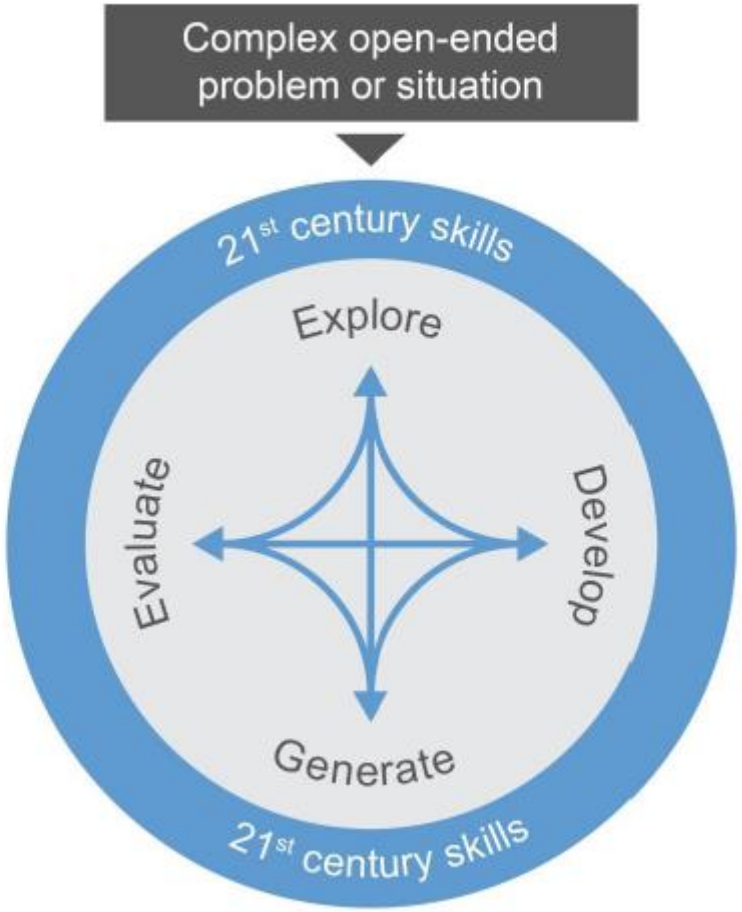
Assessment

Summative internal assessment 3:
Extended response (25%)

Summative external assessment:
Examination (25%)

Problem Solving Methodology

Figure 4: Phases of problem-based learning



Key concepts

- **abstraction** — underpins all subject matter, particularly subject matter relating to the concepts of data representation, and specification, algorithms and implementation
- **data** — collection (properties, sources and collection of data), representation (symbolism and separation), and interpretation (patterns and contexts)
- **specification** — descriptions and techniques
- **algorithms** — encoding, tracing, decoding and describing
- **implementation** — translating and programming
- **digital systems** — hardware, software and networks, including the internet
- **interactions** — people and digital systems, user needs, user interface (UI) and user experience (UX); data and processes
- **impacts** — social and ethical; sustainability and empowerment
- **project management** — including project/software development models.

Unit 1: Creative Coding

Students will investigate user-interface (UI) design, algorithms, coding and user-experience (UX) concepts to enable them to generate small interactive solutions using programming tools.

- solve an identified real-world interactive digital media problem that requires a new or re-imagined solution.
- gain a practical understanding of coding concepts.
- Teachers and students select a technology context that suits their interests and motivations.

Unit 1 Contexts:

- interactive learning objects
- interactive games
- productivity solutions
- interactive media sites
- coded drawing and animation
- robotics
- mobile applications.

Example languages /frameworks

Python,
JavaScript,
Unity 3D (C#),
Visual Basic.NET
C#,
HTML5/CSS3/JavaScript and web framework/s
Processing.org, Processing.js, JavaScript with Canvas, C++, C, Robot C,
Arduino,
Visual Studio
JQuery
Phonegap, Xamarin

Issues: Languages; Algorithmic Design Methodologies, …

- Languages? Optional; what's missing
- a procedural text-based language (p22)
- develop symbolic representation skills using flow charts and/or pseudocode (p22)
- apply acquired knowledge of flow charting and/or pseudocode processes to explain logical order of instructions (p23)

Top 10 Programming Languages in 2017

- Java
- Python
- PHP
- Go
- Javascript
- Visual Basic.NET
- Ruby on Rails
- Swift
- C#
- Scala

Scala is a type-safe programming language that incorporates both object-oriented and functional programming into an extremely concise, logical, and extraordinarily powerful language.

Scala, compared to Java, is ultimately easier to use and increases productivity.

Unit 2: Application and data solutions

Write text-based code to generate a website, mobile application or desktop application that interacts with a database via structured query language (SQL).

Students are required to understand the structure of a database, along with the impact of primary and foreign keys and data types on the performance of the database.

Students evaluate the security, privacy and ethical impacts of storing data in databases from individual, organisational and government perspectives.

Unit 2: Application and data solutions

Technology contexts

- website
- mobile application
- desktop application

Students are to use an appropriate RDBMS such as:

- MySQL/MariaDB
- SQLServer
- SQLLite
- PostgreSQL

or any other RDBMS using SQL

Use ER Diagrams or a Relational Schema (RS) to create database tables.

What about ORM??

“If you want to build databases that work well, you have to get the conceptual model right,

and starting with the 9 steps of Halpin's CSDP (the fundamental part of Object Role Modelling) to get a refined and validated fact type diagram as a first level conceptual schema is better than anything ER will give you

(which in turn is probably less damaging that anything UML will give you).”

–Tom Thomson @ sqlservercentral

RDBMS vs NoSQL

- Facebook, Twitter, LinkedIn and Netflix are well-known users of NoSQL database technology, as it works well with the large data sets they need to manage.
- However, many organizations find that traditional databases are still best for their business needs.
  - Most web developers building dynamic websites interact with databases every day.
  - And typically with relational databases like MySQL or Postgres
- MVC: But with the recent proliferation of web frameworks like Rails and Django, many web developers rely totally on Object-Relational Mappers for interacting with their database.
- Also ASP.NET MVC gives you a potent, patterns-based way to build dynamic websites and generate database objects with Entity Framework

Yr 12: Unit 3: Digital Innovations

- Students will learn about **agile project management,**
- and work collaboratively to generate (prototype) solutions with creative user experiences by combining code and data.
- Students analyse the requirements of particular groups of people and use knowledge and skills of
  - problem-solving,
  - project management,
  - computational, design and systems thinking.

Unit 3: Digital Innovations - Contexts

- Computer generated media
  - *dynamic background images for a game or website based on user input or stored data,*
  - *computer generated artworks or animations that react to user proximity or*
  - *computer generated analytics imagery for an interactive video such as the path of a ball or player in a sports game.*
- Websites or web applications
- Interactive media including
  - games,
  - software applications,
  - learning objects and
  - simulations
- 'Internet of Things' including
  - robotics and
  - wearable technology
- Mobile apps

Unit 3 Coding:

For Unit 3, the programming language/s must allow the following operations to be performed:

- support the following programming structures:
  - selection, iteration, sequence, functions
- support object-oriented coding approaches, including:
  - instances, classes, libraries
- internal documentation (comments)
- setting variable's or field's data type to Boolean, whole number, number with a decimal place, date and text
- creating and manipulating variables with 2D data structures.

Unit 3 Data

For Unit 3, the programming language/s must allow the following operations to be performed:

- read and write video, image, sound, binary and text file formats
- connect to a data stores containing structured and unstructured data
- retrieve data from the data store
- manipulate data in the data store by inserting data, updating data and deleting data
- execute and read the result of a SQL SELECT statement, including WHERE, GROUP BY, HAVING, ORDER BY, sub-selection and inner-joins phrases.

Project Management: The Good, the Bad, & the Ugly

- A vital skill
- One of the best things we taught our IT students, according to some of them:
  - ex-ITS/IPT, now Uni Student:

    'The most useful skill I learned in ITS/IPT'
- Parents who are Project Managers have critiqued our approach and been impressed,
- But there are many different possible approaches to Project Management, even within Agile
  - Great current demand for Agile 'Scrum Masters'

Agile Project Management:

- analyse project risks and possible risk mitigation strategies
- develop project management protocols and plans
- evaluate collaborative and creative processes
- manage project timelines using agile project management strategies and tools, including:
  - team boards
  - user stories
  - sprint cycles
  - sprint backlog
  - sprint burn-down
  - scrums
- prioritise project requirements
- understand and use agile project management approaches, terminology and tools, including:
  - sprint planning meeting
  - scrum
  - sprint cycle
  - sprint goal
  - sprint burn-down
  - sprint review
  - sprint backlog
  - team board
  - user stories
- use **constructed success criteria** to evaluate effectiveness of project management processes as applied to the project and the real world.

Agile: Pro's

- In Agile, processes are secondary to the requirements of the work.
- *Agile solves a specific management issue, namely, how to combine disciplined execution with creativity and innovation.*
- Agile way of thinking:
  - small batch, frequent iterations, release early and often, delay decisions until the last moment, build quality in from the beginning.

Agile: Con's

- **It's more work:** Using customer feedback means having to collect and process it. That means delivering software is only the first part. Iterating in the most important.
- **There's no blueprint**: There are many agile software frameworks and methodologies. Even after you find one that suits you, it's likely that you'll have to tailor it to your team. The only way you know what works best, is by experimenting.
- **There's no hand holding:** Most agile software teams autonomously organize their work. You can't direct the team step-by-step with a massive Gantt chart
- Scrum Master is a coach/facilitator
  - how can an in-experienced student fulfil this role?

Agile: Con's

"It's time for this culture of terminal juniority, low autonomy, and aggressive management to die.

These aren't just bad ideas. They're more dangerous than that, because there's a generation of software engineers who are absorbing them without knowing any better.

There are far too many young programmers being doomed to mediocrity by the idea that business-driven engineering and "user stories" are how things have always been done.

This ought to be prevented; the future integrity of our industry may rely on it.

"Agile", at least as bastardized in every implementation that I've seen, is a bucket of nonsense that has nothing to do with programming and certainly nothing to do with computer science.

Business-driven engineering, in general, is a dead end. It ought to be tossed back into the muck from which it came. "

-Michael O Church: - https://michaelochurch.wordpress.com/2015/06/06/why-agile-and-especially-scrum-are-terrible/

Unit 3 Assessment Tasks

1: Technical feasibility prototype (15%)

Working individually, students iteratively explore, develop, generate and evaluate algorithms and a low fidelity prototype for a problem, situation or need, drawn from one of the Unit 3 technology contexts.

2. Digital Solution (35%)

Working in groups, students use an agile project management process to iteratively explore, develop, generate and evaluate a digital solution for a problem, situation or need, drawn from one of the Unit 3 technology contexts.

In most cases, teams will build on problem solutions prototyped and proposed in the Unit 3 internal assessment 1.

Summative internal assessment 2: Digital solution (35%):

Summary of the instrument-specific marking guide

Criterion	Objectives	Marks
Retrieving and comprehending	1 and 2	10
Analysing	3 and 4	10
Developing, testing and evaluating	5, 6 and 7	10
Communicating	8	5
Total		**35**

The student work has the following characteristics:	Marks
• effective analysis and in-depth critique of a digital prototype to understand prototype requirements • comprehensive development of success criteria for components of a digital solution • accurate application of computational and systems thinking techniques and processes to structure: – creative and thoughtful user interfaces – sophisticated project plans – well-structured data and coding components of a digital solution.	9–10
• considered analysis and convincing critique of a digital prototype to understand prototype requirements • logical development of success criteria for components of a digital solution • accurate application of computational and systems thinking techniques and processes to structure: – effective user interfaces – purposeful project plans – valid data and coding components of a digital solution.	7–8
• simple analysis and logical critique of a digital prototype to understand prototype requirements	

Unit 4: Digital Impacts

- In Unit 4, students explore how digital technologies are being used and experienced in everyday life.
- They will learn to analyse and understand processes to safeguard and protect data, identify benefits and risks and explore the impact of preferred digital futures.
- Students apply formal object-oriented programming concepts, practices and perspectives to safeguard and protect data.
- They plan and generate object-oriented code that incorporates the use of data, uses existing code libraries, and connects to representational state transfer (REST) services to enable interactivity.
- They will use these developed components and case study examples to explore the impact of digital solutions relating to **data security, integrity, privacy and change**.
- Students will analyse how people interact with and experience these digital technologies.

Unit 4 Programming language

In Unit 4, the programming language must allow the following features to be performed:

- text-based syntax
- classes and objects
- properties, methods
- inheritance, encapsulation, polymorphism, abstraction
- interactivity, input and output to data stores (data files and databases)
- availability to connect to networked REST web service for data acquisition or transfer
- code interaction with add-on code libraries from other sources.

Assessment: Summative - Security folio (25%) & 70% of unit time

- The response is a coherent work that documents the iterative process undertaken to develop a solution to a problem.
- It includes data, tables, algorithms, diagrams, sketches, illustrations, and coded classes where/with? appropriate prototypes.
- Part 1 — DATA:
  - Students are required to create **a prototype application that interconnects data via a web service and a database** from which the data sources provide an opportunity to visualise and perform abstraction to support a user experience.
- • Part 2 — SECURITY:
  - Students are required to develop an **individual cipher resource toolset** using object-oriented programming techniques and security concepts and methods. This will include the use and support of external libraries.
- Part 3 — USER EXPERIENCE:
  - Students are required to **analyse a digital solution case study** based on knowledge and skills developed in previous tasks and through individual research to assess the impacts of a future user experience.

External Assessment (50% of Unit 4)

- Lack of clarity on what this will look like.
- What should be examined?
- If ‘Creative Coding’ was in Year 12 it may be more suitable for being assessed in an external exam?
- Given only 30% of Semester 2 available to teach Semester 2 material and prepare for this exam, this time constraint may be significant.

Digital Solutions – Some Issues:

Too much Content??? A common reflection of IT teachers I have spoken to.

Pre-dominance of OOP – question complexity; appropriateness at this level.

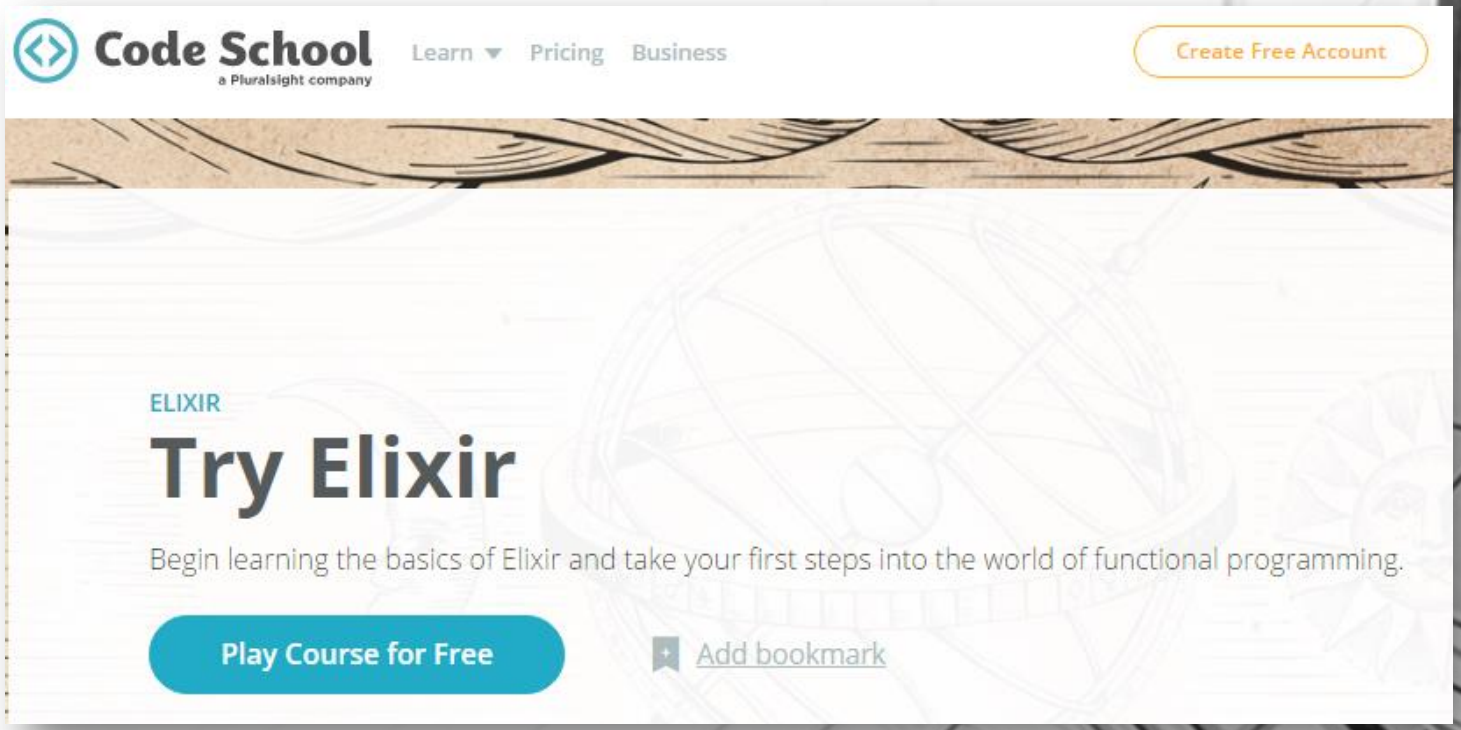
Some Coder's comments:

- *Although object-oriented programming (in its myriad forms) remains a dominant theme in industrial software development, the use of object-oriented languages, such as Java, at the introductory level introduces considerable complexity and distracts from the core goals at the introductory level.*
- *Programmers mostly combine several programming techniques or paradigms, or ways to solve a problem. Functional, Procedural, OOP, logical…*
- *Object-oriented programming is a collection of procedural snippets in an organized fashion. I think the lesson you are learning is that object oriented methodology helps maintain organization and maintainability. There are a lot of programmers who cannot make this distinction and will claim their programs are object oriented when they are more procedural.*
- *Every OOP method is a short procedural program. If you don't know how to combine the small pieces (types, literal values, variables, operators, = assignment, if, for, etc) into bigger pieces (methods), how can you ever hope understand OOP.*
- *Really understanding the ideas behind OO is hard, as a result most supposedly OO code is really mostly procedural.*

Carnegie Mellon University

Replaced OOP Course with Functional Programming (#15-150 Spring 2017)

- The purpose of this course is to introduce the theory and practice of *functional programming (FP)*.
- The characteristic feature of FP is the emphasis on *computation as evaluation*.



Issues:

- Some significant topics not included
  - *eg. Nothing in course directly on AR & VR*
- OOP is not necessary to teach Ciphers, or Machine Learning. There are many viable approaches including functional languages.
- The original content of Unit 4 in Draft 1 seemed a much more appropriate and valid approach (esp. if OOP was removed).
- **I believe the most interesting and enjoyable unit for the students will be Unit 1.** Unfortunately though they will get no contribution to their final grade from any assessment they do in this unit.

- One approach to resolve this would be to swap Unit's 1 & 3. Return the content of Unit 4 back to Draft 1 or similar
  - *but without the OOP - have perhaps as an option along with functional programming but not mandated.*
  - Then place Unit 1: Creative Coding as the first unit in Yr 12 with the Unit 3: Digital Innovation as the final unit.
  - This would both encourage and help the students gain a better mark in Year 12, as well as place a more appropriate focus on both algorithmic programming and the great contexts being offered in the Digital Innovations unit.
- There needs to be more emphasis placed on Algorithmic Design
  - i.e the use of Structure Design Charts or Nassi- Schneiderman Diagrams
    or Structure Diagrams (Peter Juliffe)
  - evidence to support this?
- A Real Positive:
  - The use of actual marks rather than the current vague and easily 'massaged' criterion approach for IPT and ITS is welcome.

What about the new Design Subject?

The course introduction does state that some IT is included:

> *"... (this) course of study in Design can establish a basis for further education and employment in the fields of architecture, **digital media design,** fashion design, **graphic design**, industrial design, interior design and landscape architecture."*

- *Prototyping skills in* digital modelling — interactive experiences
  - interface wireframe
  - website simulation
  - mobile application simulation
  - virtual reality
  - augmented reality
- *Prototyping skills in* digital modelling — sequential experiences
  - digital presentation
  - video with or without audio (sounds, music, dialogue)
  - walk-throughs of spaces
  - short video loops such as GIFs and cinema-graphs
  - animated information graphics
  - animation
- **But ... very little of ITS can be seen here.**

Prophecies of Doom!

- *"IT Teachers will not want to teach the new Digital Solutions subject; students will not want to enrol in it, and hence it will DIE."*
  - paraphrasing a very experienced IPT teacher

- "The new DESIGN course is just Graphics re-done; there is no ITS to be seen here …"
  - paraphrasing another very experienced IT teacher

Only One (1) IT Subject:

From QCAA:

- The QCAA state-wide feedback revealed that there was a

  "resounding voice"

  for only **one (1) IT subject**

  in Year 11 & 12 going forward.

- *Apparently, all the ITS teachers and the IPT teachers and the ICT SAS teachers saw no need for the separate skills and topics that they currently teach!?*

IT Skills needed in the future workplace

IT skills required now requited in workforce as classifiable into the three aspects, or levels of competency.

They are:

- **Digital Literacy;**
- **Digital Fluency, and**
- **Digital Mastery,**

Crunched by the numbers

- The report *'Crunched by the numbers: the digital skills gap in the workforce'* states that:

  *" ... in the **middle-skill job market**, the world is increasingly divided between the jobs that demand digital skills and those that don't - and the ones that don't are falling behind.*

  [The report goes on to suggest that] much of the debate over technology in the workforce has focused on sophisticated skills, such as writing code.

- ***But the more significant impact on the middle-skill job market is in the humbler world of everyday software:***
  - ***spreadsheets and word processing,***
  - ***programs for medical billing and***
  - ***running computerized drill presses.***

- *[The argument is made that] to a large extent, a job seeker without the ability to use this software won't even get in the door.*

- *This research documents the extent to which entire sectors of the US economy have no place for workers who do not at least have the basic digital skills to undertake tasks like word processing and maintaining spreadsheets. ..."*

The World Has Changed:
We are at the beginning of a major Technology surge:

A little new Science
Computing power increases/Moore's Law
Data explosion
Democratization of

- Knowledge
- Digital Power
- Innovation

Leading to:

- **Disruption of Industries**
- **Displacement of workers**
- **Dematerialization of the economy**

Resulting in:

a) the **Digitization** of more and more information, goods, and services,

b) **Globalisation**
- telecommunications,

- transportation,

- networks and standards.

c) **Intelligent Systems**

– Machine Learning & Robotics

The World Has Changed:

There are 7 new job clusters in Australia

There are more than 1,000 different occupations in Australia. This might seem like a bewildering choice for a young person starting their career, but actually many of these jobs are related in the sense that they involve similar skills, day-to-day tasks and work environments (some of which are surprising).

By using a first-time methodology for analysing millions of job advertisements, these occupations can actually be grouped into just 7 'clusters of work':

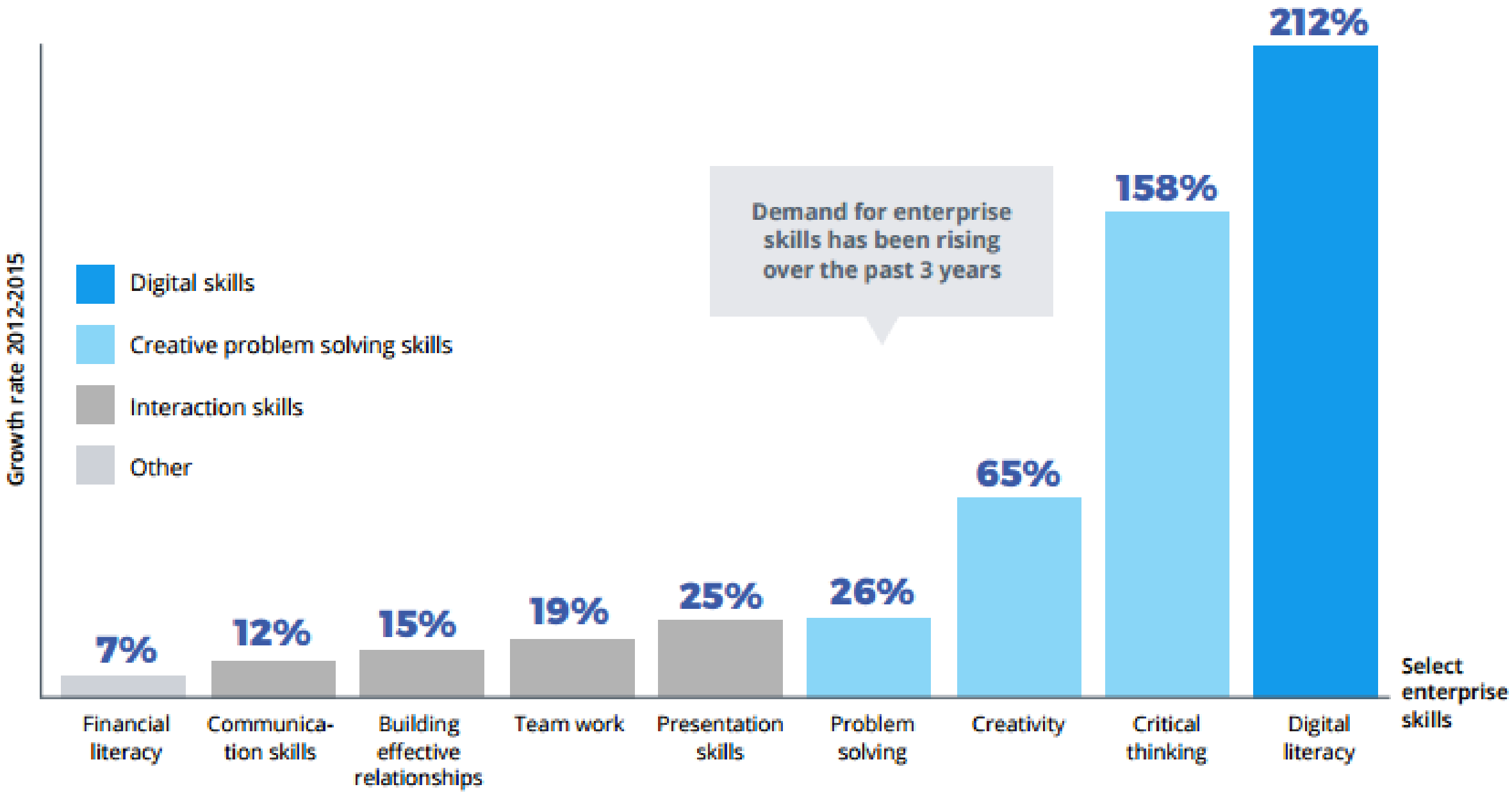
- There are some **13 transferable enterprise skills** that all the jobs in 1 ‘cluster’ share.
- **The demand for digital skills is up by 212%** over the last 3 years **yet over 27% of school leavers have low proficiency in digital literacy** (let alone any digital skills that could be classed at the level of fluency or mastery).
- Also the demand for critical thinking skills is up 158% (a skill set that can be dramatically improved through the effective use of digital technology).

”20 years ago, if you wanted to cure cancer, you would have gone into medicine, but if you want to cure cancer today you should go into software engineering.

The possibilities are endless.”

- ***Anna Emerson, SPLC old-scholar & Google Software Engineer***

Growth in proportion of jobs requesting each skill, %, early-career jobs, 2012-2015[12]



Portability within a ‘Cluster’

The intensity[1] of skill demand for all occupations are compared, and occupations with highly-similar skill intensities are deemed ‘portable’

Skill requested	Civil Engineer	Architect	Skill intensity gap[2]	
Problem solving	**53%** of jobs request this skill	**51%** of jobs request this skill	2%	✓
Mathematics	52%	44%	8%	✓
Computer-assisted drafting/design	63%	63%	8%	✓
Interior design	4%	23%	-19%	✗
Technical drawing	42%	40%	2%	✓
Project planning	38%	35%	3%	✓
Microsoft Office	71%	64%	7%	✓
Communication skills	80%	85%	-5%	✓
Contract management	78%	70%	8%	✓
Concept development	48%	49%	-1%	✓

Exhibit 6: Which job clusters have the strongest future prospects?

Clusters	Growth and Automation	Future Prospect	Example jobs within the cluster that have strong future prospects (occupations grew 2010-2015 and risk of impact of automation is <70%)
'The Generators'	Job Growth (2010-15) 7.4% Affected by automation 45%	Moderate	ICT sales reps Retail supervisors Café or restaurant managers Call centre team leaders Entertainers & variety artists Hospitality managers Sports instructors Bank managers
'The Artisans'	Job Growth (2010-15) 5.6% Affected by automation 77%	Weak	Carpenters & joiners Landscape gardeners Electrical engineering technicians Mechanics Upholsterers Electricians
'The Carers'	Job Growth (2010-15) 18.0% Affected by automation 26%	Strong	General practitioners Nurses Podiatrists Dental technicians Health promotion officers Pharmacists Veterinarians Radio-graphers Physio-therapists Tour guides Beauty therapists Make-up artists Community health workers Massage therapists Cardiac technicians Anaesthetic technicians Childcare workers Special education teachers Fitness instructors Emergency service workers Psychiatrists Paramedics Surgeons Social workers Occupational therapists
'The Coordinators'	Job Growth (2010-15) 3.0% Affected by automation 71%	Weak	Receptionists Travel attendants Florists ICT support technicians Admissions clerks

'The Designers'

Job Growth (2010-15)

13.1%

Affected by automation

43%

Moderate

- Construction project managers
- Civil engineers
- Computer network & system engineers
- Project administrators
- Electrical engineers
- Architects
- Industrial engineers
- Geologists
- Mining engineers
- Landscape architects
- Food technologists

'The Informers'

Job Growth (2010-15)

7.6%

Affected by automation

36%

Strong

- Policy analysts
- Statisticians
- Physicists
- Gallery or museum curators
- Economists
- Laboratory managers
- Human resource advisers
- OH&S advisers
- Financial brokers
- Solicitors
- Technical writers
- Actuaries
- Detectives
- Organisa-tional psychologists
- Market research analysts
- Journalists
- Primary & secondary school teachers

'The Technologists'

Job Growth (2010-15)

19.0%

Affected by automation

50%

Strong

- Programmers
- Software engineers
- Web developers
- Database administrators
- Web designers

New Cluster?

Additional job clusters may arise, based on new occupations and new skills being demanded and valued by employers

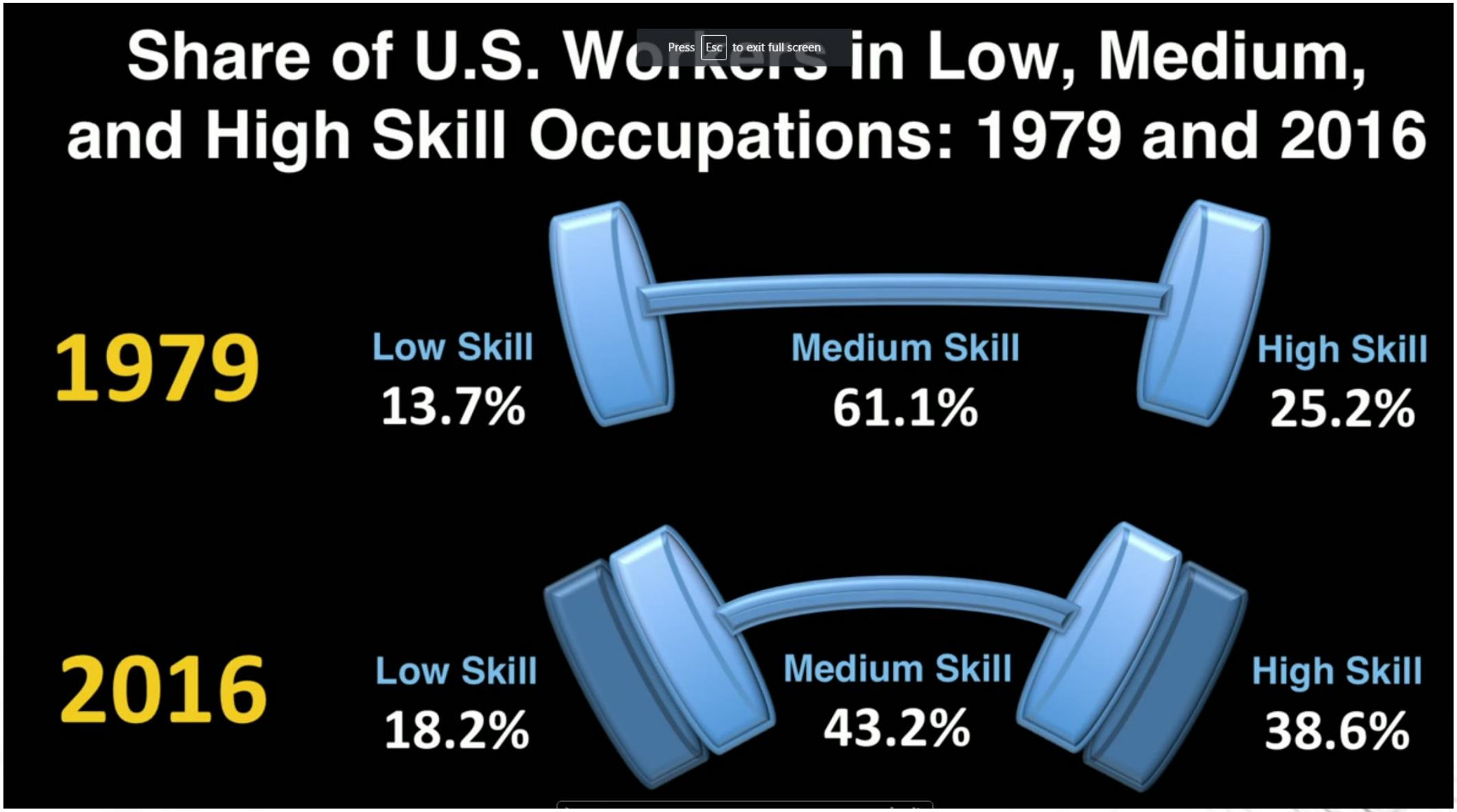
AI:

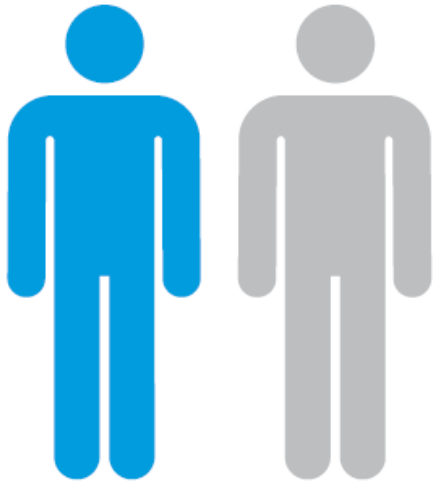
- Australia is ranked last in the world when it comes to accessing the skills needed to deploy AI technologies.
- Within 10-15 years, nearly 40% of Australian jobs will be automated.
- “Using complex algorithms, Australian businesses are programming computers to analyse, learn and action vast volumes of data to help
  - combat credit card fraud,
  - speed up new medicine discoveries or
  - even improve your online shopping experience,”
- “We’re seeing robotics AI in the form of
  - driverless trucks that improve safety for Australian mine workers,
  - autonomous machines manufacturing high-tech products
  - and even a robotic pharmacist being used at a Perth hospital to order and dispense lifesaving drugs,”


CAFEX
CAFEX

Not all doom and gloom – consider ATM's

- Since the introduction of ATM's into the USA 45 years ago, the number of Bank Tellers has doubled!
  - Over 100,000 new Teller positions since 2000
  - The main focus of what they do has changed though
- **In 1900, 40 % of all US employment was on farms. Today, it's less than 2%**
  - And yet, a greater percentage of US Adults have been employed every decade since.
- Technology magnifies our leverage and increases the importance of our
  - **Our expertise,**
  - **Our judgment and**
  - **Our creativity.**


Press Esc to exit full screen
Share of U.S. Workers in Low, Medium, and High Skill Occupations: 1979 and 2016
1979
Low Skill
13.7%
Medium Skill
61.1%
High Skill
25.2%
2016
Low Skill
18.2%
Medium Skill
43.2%
High Skill
38.6%



1 in 2

Australians will need skills such as programming, software development and skills to build digital technology.

There is a very serious need to gain basic digital literacy skills

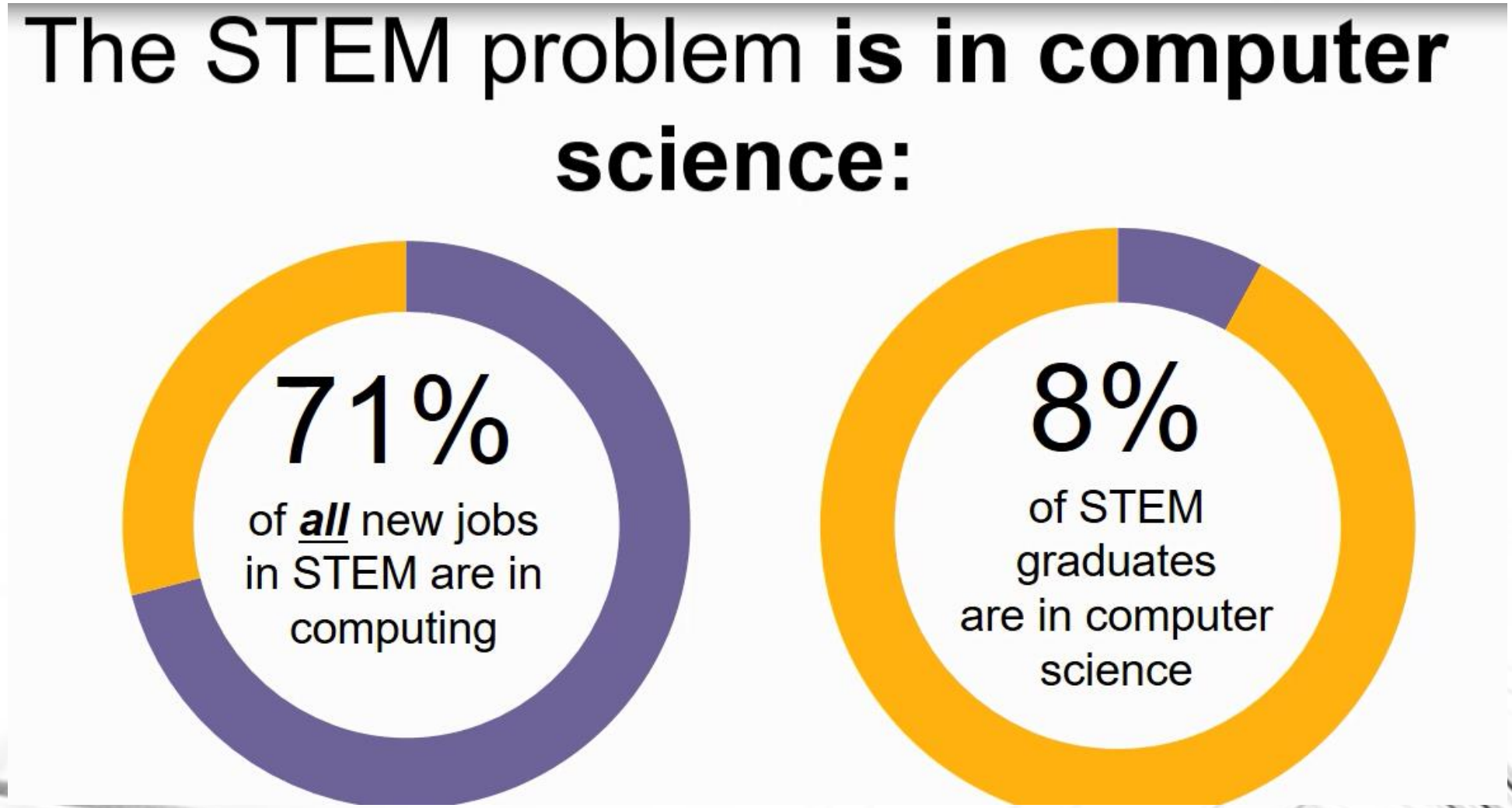
- *Advanced digital skills will be required for the future,*
  - ***'computational thinking',***
  - ***'new-media literacy',***
  - ***'design mindset',***
  - ***'virtual collaboration'.***

'The Second Machine Age' will need good skills in:

- **ideation,**
- **large-frame pattern recognition, and**
- **complex communication**

- The clusters with the strongest future potential are:
  - **The Carers,**
  - **The Informers, and**
  - **The Technologists**
    - All very much IT centric.

STEM:


The STEM problem **is in computer science:**
71%
of ***all*** new jobs in STEM are in computing
8%
of STEM graduates are in computer science

But there's more! A New Economic Model

Resulting from

a) the **digitization** of more and more information, goods, and services,

b) **Globalisation**

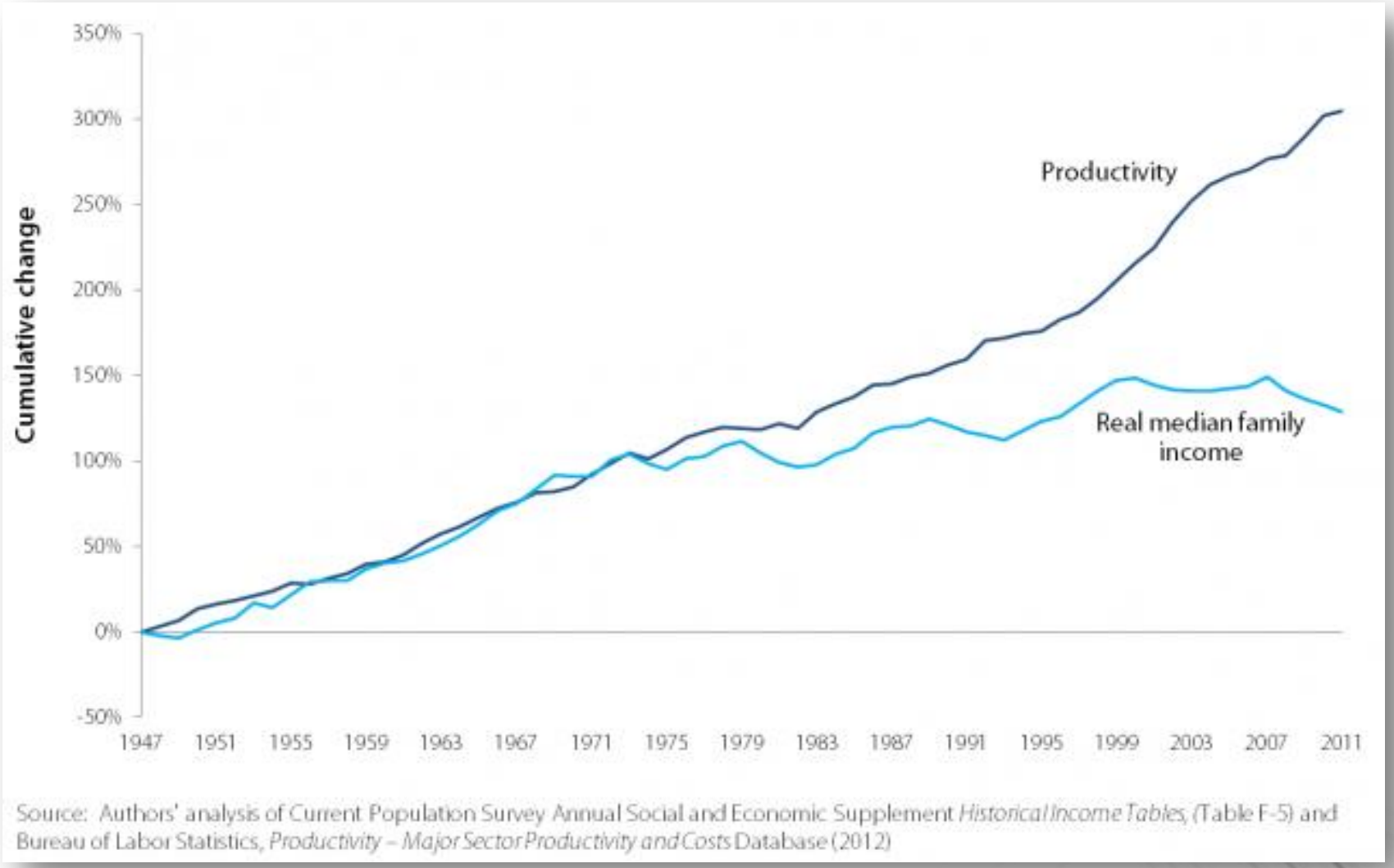
- telecommunications,
- transportation,
- networks and standards.

c) Intelligent Systems

– **Machine Learning** & Robotics

Andrew McAfee & Erik Brynjolfsson

The Future of Wealth Distribution



Source: Authors' analysis of Current Population Survey Annual Social and Economic Supplement *Historical Income Tables*, (Table F-5) and Bureau of Labor Statistics, *Productivity – Major Sector Productivity and Costs* Database (2012)

Co-CEO & co-founder of Atlassian - Mike Cannon-Brookes:

- "If we're not investing in technology we're completely stuffed as a nation."
- "I think fundamentally it's about talent -- that's our biggest challenge in this country. **Talent, training, and STEM education in high schools is critically important**."
- … if the nation does not employ some form of Computational Thinking in schools, … we won't have the workforce in 20 - 30 years' time that we will need.
- "In the UK, kindergarten through 12 do Computer Science education; various states in the US are starting to mandate Computer Science as one of the things you graduate with in **year 12 as a mandatory subject like Maths and English**, …"

Digital Literacy:
- Mandatory requirement for all students:

- Countries such as Vietnam and Mexico are setting a National Standard that their citizens have access to digital literacy training such as the IC3, and as it is Government endorsed with provisioned resources to make it financially viable.
- In Australia, the majority of investment is attributed to STEM and in particular coding initiatives.
- Unfortunately, this is really only catering for the group of students who would follow the IT Mastery pathway, that is the 'Digital Solutions' (Mastery) subject
  - and this means that some 80+% of those who will who use ICT as part of the general workforce population are omitted from the these STEM focussed funding initiatives.

IC3 GS5 EXAM OBJECTIVES

Computing Fundamentals

1. Mobile Devices
   - Using cell phones, voicemail, SMS, notifications
2. Hardware
   - Device types, storage, networking, Wi-Fi, platforms, compatibility, internet, configurations
3. Computer Software Architecture
   - OS and updates, preferences, users, file management, navigation, software installation, troubleshooting
4. Backup and Restore
5. File Sharing
6. Cloud Computing
   - Concepts, Utilization, web apps
7. Security
   - Credentials, Browsing, anti-virus, firewalls, eCommerce safety

Key Applications

1. Common Feature
   - Shortcuts, reviewing, selecting ,cut/copy/paste, views
2. Word Processing
   - Formatting, layout, fonts, saving, printing, tables, productivity
3. Spreadsheets
   - Common terms, insert/delete, modify cells, functions/formulas, charts, formatting and manipulating data, tables
4. Databases
   - Basic concepts, metadata
5. Presentations
   - File types, views, slide management, effects, animations, software, design
6. App Culture
   - Obtaining apps, genres, uses
7. Graphic Modification

Living Online

1. Internet Navigation
   - Usage, searching, browser functionality, common terms, licensing
2. Common Functionality
   - Websites, navigation, click types
3. Email Clients
   - Applications, etiquette, emailmanagement, attachments, contacts
4. Calendaring
   - Events, sharing, usage
5. Social Media
   - Digital identity, site types, cyber bullying
6. Communications
   - Tools, SMS, chat, distance
7. Online Conferencing
8. Streaming
9. Digital Principles/Ethics/Skills/Citizenship
   - Changes in tech, personal vs professional

Digital Fluency:

- This subject could be a re-worked version of the existing ITS subject,
  - Perhaps with some related Vendor certifications such as CISCO CCNA and/or CompTIA.
- This would enable a student to have a learning pathway that may also include a VET training package so they are selecting subjects and learning for job categories using technologies other than the traditional IT specialist and may not necessarily be articulating into tertiary as approximately ***60% of students go straight into the workforce*** on school completion.
- There would be some effort needed to develop this Digital Fluency subject
  - But given the very well-refined and effective existing ITS course with schools very experienced in its implementation, it should not be difficult to create a new version that would fit appropriately into the continuum of Digital Literacy to Digital Fluency to Digital Mastery

• IT Subjects for all Year 11 & 12 students:

- Based on the current enrolment figures for IPT, it seems we cannot expect more than 10-20% of the cohort to enrol in the new non-mandatory Digital Solutions subject.
- If we see the IT skills required as classifiable into the three aspects of
  - **Digital Literacy;**
  - **Digital Fluency, and**
  - **Digital Mastery,**
- then the **Digital Solutions** course clearly offers a course we can classify as **Digital Mastery.**

Where to Now?

- **What are your thoughts?**
- **What can we do if we see some serious limitations**
- **Design Draft 2 still open for feedback**