



## Stichting NIOC en de NIOC kennisbank

Stichting NIOC ([www.nioc.nl](http://www.nioc.nl)) stelt zich conform zijn statuten tot doel: het realiseren van congressen over informatica onderwijs en voorts al hetgeen met een en ander rechtstreeks of zijdelings verband houdt of daartoe bevorderlijk kan zijn, alles in de ruimste zin des woords.

De stichting NIOC neemt de archivering van de resultaten van de congressen voor zijn rekening. De website [www.nioc.nl](http://www.nioc.nl) ontsluit onder "Eerdere congressen" de gearchiveerde websites van eerdere congressen. De vele afzonderlijke congresbijdragen zijn opgenomen in een kennisbank die via dezelfde website onder "NIOC kennisbank" ontsloten wordt.

Op dit moment bevat de NIOC kennisbank alle bijdragen, incl. die van het laatste congres (NIOC2025, gehouden op donderdag 27 maart 2025 jl. en georganiseerd door Hogeschool Windesheim). Bij elkaar zo'n 1500 bijdragen!

We roepen je op, na het lezen van het document dat door jou is gedownload, de auteur(s) feedback te geven. Dit kan door je te registreren als gebruiker van de NIOC kennisbank. Na registratie krijg je bericht hoe in te loggen op de NIOC kennisbank.

Het eerstvolgende NIOC vindt plaats in 2027 en wordt dan georganiseerd door HAN University of Applied Sciences. Zodra daarover meer informatie beschikbaar is, is deze hier te vinden.

Wil je op de hoogte blijven van de ontwikkeling rond Stichting NIOC en de NIOC kennisbank, schrijf je dan in op de nieuwsbrief via

[www.nioc.nl/nioc-kennisbank/aanmelden\\_nieuwsbrief](http://www.nioc.nl/nioc-kennisbank/aanmelden_nieuwsbrief)

Reacties over de NIOC kennisbank en de inhoud daarvan kun je richten aan de beheerder:

R. Smedinga [kennisbank@nioc.nl](mailto:kennisbank@nioc.nl).

Vermeld bij reacties jouw naam en telefoonnummer voor nader contact.

# Designing an Android App Development Course using 4C/ID

Marco Marcellis

[m.m.c.m.marcellis@hva.nl](mailto:m.m.c.m.marcellis@hva.nl)

Mobile Application Development lecturer



# Outline

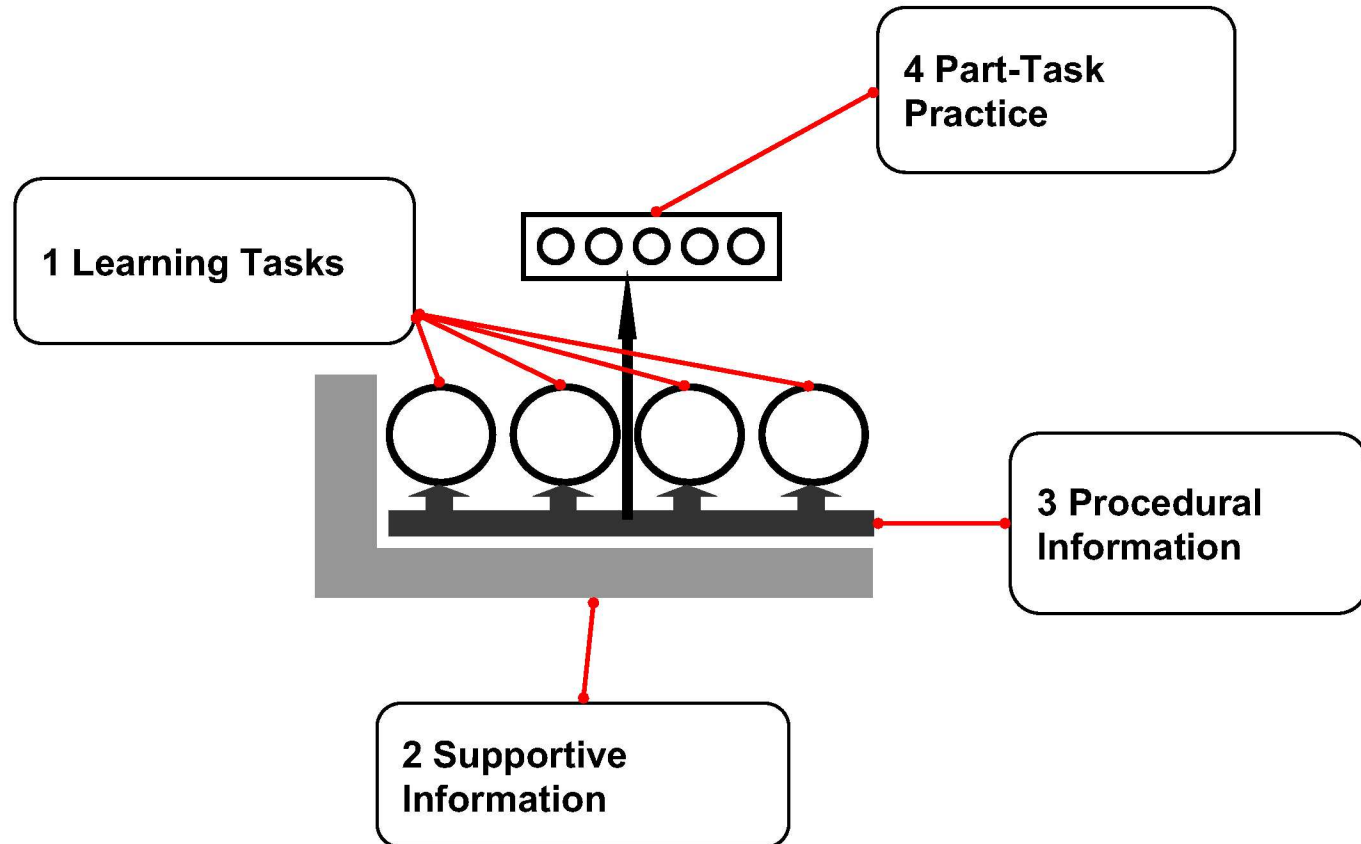
- Facts about the course
- Four-Component Instructional Design (4C/ID) method
- The design of the learning environment
- The learning environment

# Course Mobile Application Development

- We teach the students to develop an Android app
- Blended: face-to-face and online
- Part of the minor Mobile Development
- Course consists of 4 credits
- Seven-week course
- Course runs each semester for the part-time and full-time programmes
- About 100 students each semester
- Different students
  - different levels
  - different years
  - different nationalities

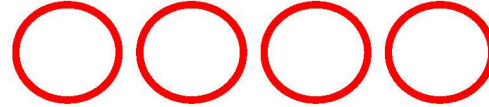
Applied  
the 4C/ID model  
to design the course

# The Four-Component Instructional Design



Components of 4C/ID	Ten Steps to complex learning
1. LEARNING TASKS	1. Design Learning Tasks
	2. Develop Assessment Instruments
	3. Sequence Learning Tasks
2. SUPPORTIVE INFORMATION	4. Design Supportive Information
	5. Analyze Cognitive Strategies
	6. Analyze Mental Models
3. PROCEDURAL INFORMATION	7. Design Procedural Information
	8. Analyze Cognitive Rules
	9. Analyze Prerequisite Knowledge
4. PART-TASK PRACTICE	10. Design Part-Task Practice

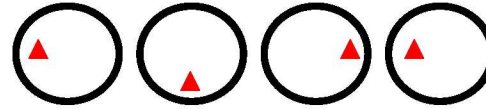
## Learning Tasks



- Whole task  
=> In each task the students build a complete Android app
- Authentic  
=> Tasks are ideas which the students came up with
- Real task environment  
=> The apps are built with Android Studio



## Variability of practice



Vary app categories:

Shopping

Gaming

Health

Education

...

Vary User Interface

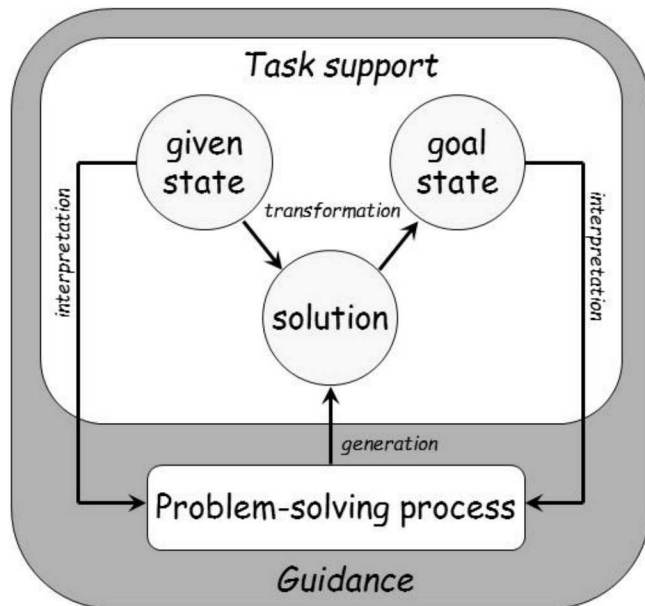
Menus

Layouts

Dialogs

...

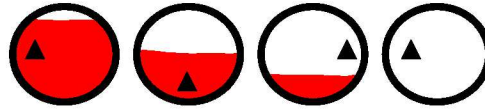
# Task Support and guidance



- Given state:  
requirements including designs
- Goal state:  
An Android app which has implemented the requirements
- Solution:  
a sequence of steps from the given to the goal state

Figure 2. task support and guidance

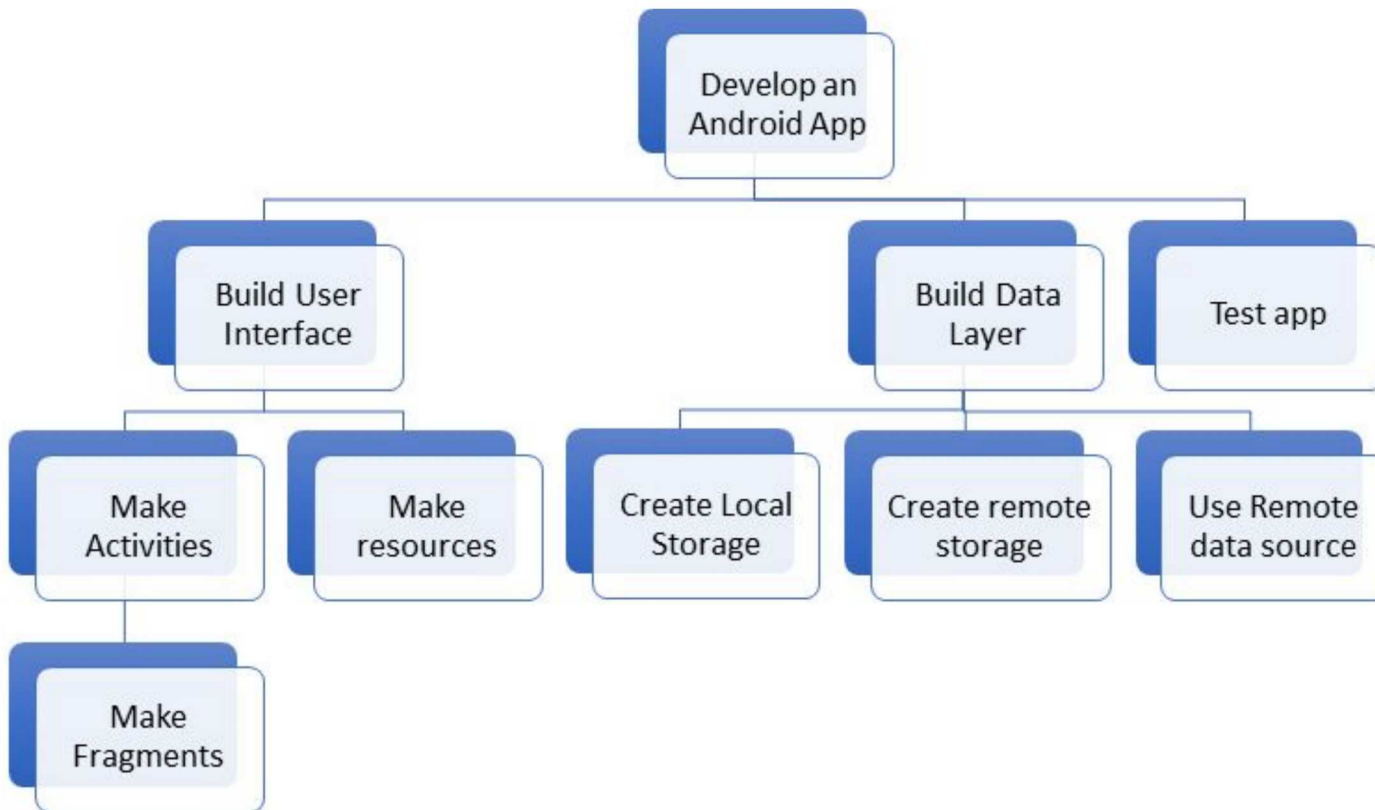
(van Merriënboer & Kirschner, 2017, p. 68)



# Scaffolding: completion strategy

	<b>Worked out example</b>	<b>Completion</b>	<b>Conventional</b>
Given state	✓	✓	✓
Goal state	✓	✓	✓
Solution	✓	Complete	Find

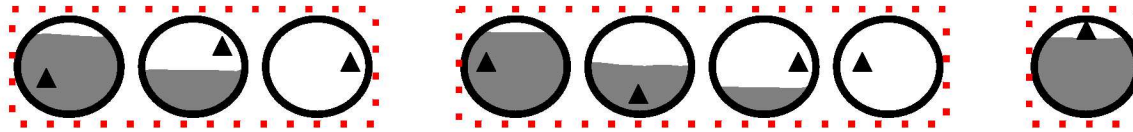
# Skill Hierarchy



Android App Development			
Skill	Criteria	Scores	Level
Make activities	At least three activities	1	Novice
Layout Resources	Constraintlayout with at least three UI elements	1	Novice
	Recycler view	1	Novice
	Tab Layout	1	Advanced
Build user interface	Usability of interface, back buttons, navigation, user feedback, rotation of screen.	1	Advanced
Make SQLite database	Define contract	½	Novice
	DBhelper class	½	Novice
Build data layer	All the data is stored locally and can be accessed using a DAO or content provider that enables retrieve, delete, update and insert. DAO Content Provider (including loader to load the data)	1	Novice
		1	Advanced
Apply Code quality	Comments, no magic numbers, naming, Literal strings in string.xml, Packages Don't repeat yourself (DRY): no repetition of code Separation of concerns:: usage of separate classes when necessary	1	Advanced
Testing your app	The app does not crash or freeze	1	Novice

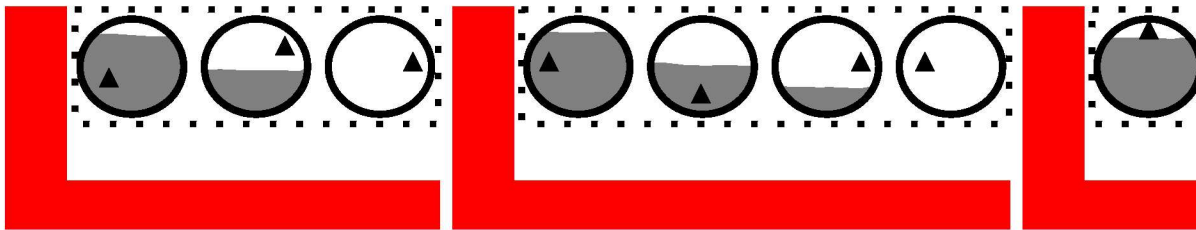
## Rubric

# Simplifying Conditions



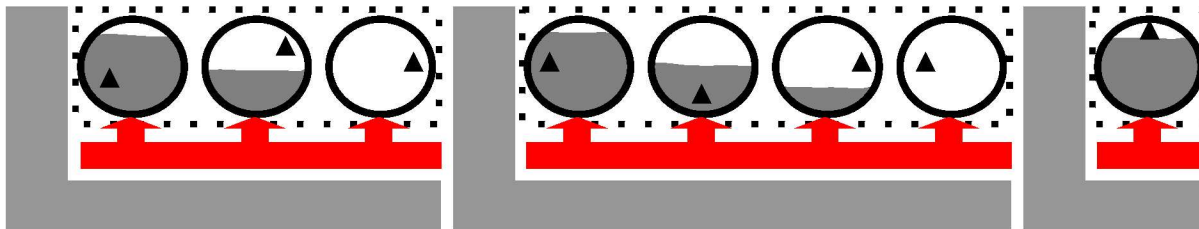
Level	1	2	3	4	5	6
Name	User Interface	Recycler View		SQLite	Content provider	Fragments
User Interface	Simple UI	Listview				Tab layout
Screens	1	1	>1			
Data-Layer				SQL lite	Content provider	

## Supportive information



- Lecture
  - Modeling example: demo which includes the problem solving process
  - Presentation of mental models and strategies

# Procedural information



Presented just in time:

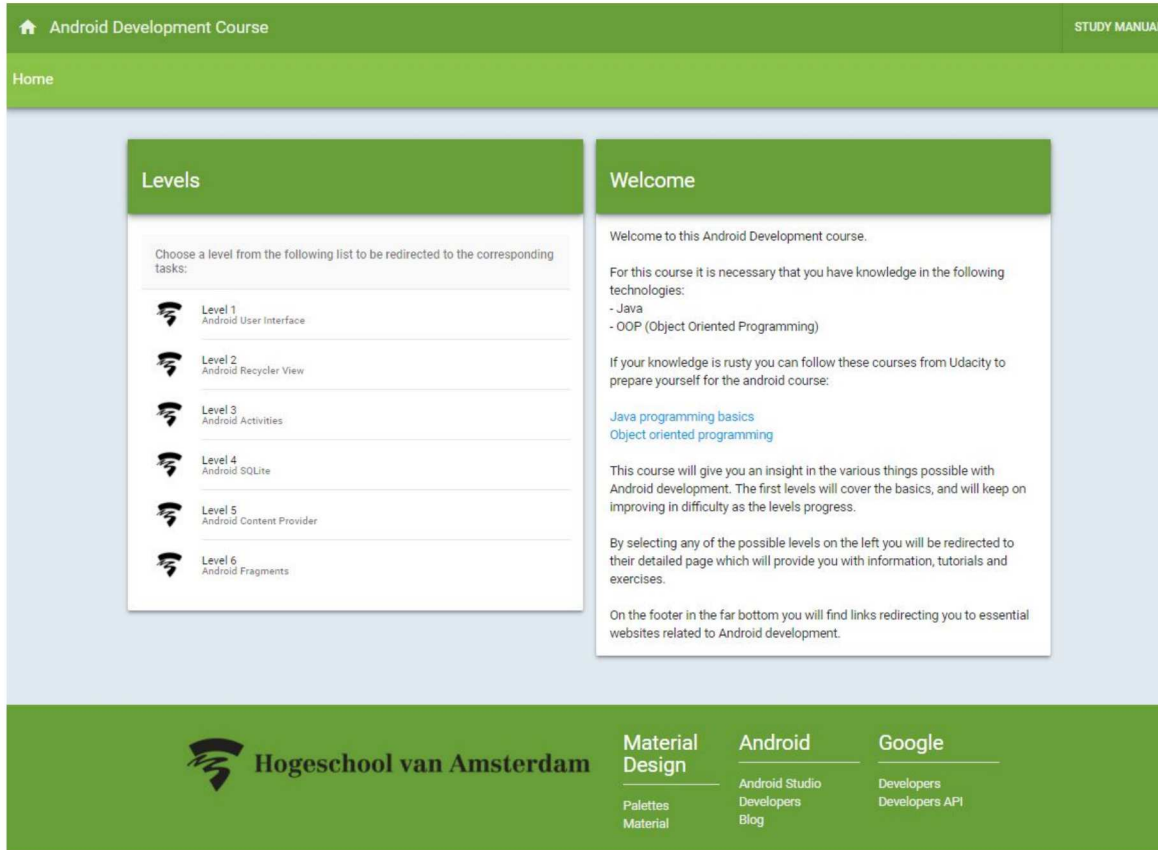
- Code comments
- Corrective feedback by
  - Android Studio (analyzers)
  - Solutions of Apps on GitHub
  - From Lecturer and other students during the practical and online using Slack



## Blended-learning model

	<b>Teacher</b>	<b>Students</b>
Face-to-Face	Presents Modeling example Presents mental models and strategies Gives feedback	Listen to lecture Work on modeling example Work on learning tasks
Online	Gives feedback using Slack	Work on learning tasks

# Android Development Course









The screenshot shows the homepage of the Android Development Course website. The page has a green header with a home icon and the text "Android Development Course" on the left, and "STUDY MANUAL" on the right. Below the header is a "Home" section. The main content area is divided into two columns. The left column is titled "Levels" and contains a list of six levels, each with a small icon and a description: Level 1 (Android User Interface), Level 2 (Android RecyclerView), Level 3 (Android Activities), Level 4 (Android SQLite), Level 5 (Android Content Provider), and Level 6 (Android Fragments). The right column is titled "Welcome" and contains a welcome message, a list of technologies (Java and OOP), a list of Udacity courses (Java programming basics and Object oriented programming), and a paragraph explaining the course structure. At the bottom of the page is a green footer with the Hogeschool van Amsterdam logo and three columns of links: "Material Design" (with sub-links Palettes and Material), "Android" (with sub-links Android Studio, Developers, and Blog), and "Google" (with sub-links Developers and Developers API).

Android Development Course STUDY MANUAL

Home

## Levels

Choose a level from the following list to be redirected to the corresponding tasks:

-  Level 1  
Android User Interface
-  Level 2  
Android RecyclerView
-  Level 3  
Android Activities
-  Level 4  
Android SQLite
-  Level 5  
Android Content Provider
-  Level 6  
Android Fragments

## Welcome

Welcome to this Android Development course.

For this course it is necessary that you have knowledge in the following technologies:

- Java
- OOP (Object Oriented Programming)


If your knowledge is rusty you can follow these courses from Udacity to prepare yourself for the android course:

- [Java programming basics](#)
- [Object oriented programming](#)

This course will give you an insight in the various things possible with Android development. The first levels will cover the basics, and will keep on improving in difficulty as the levels progress.

By selecting any of the possible levels on the left you will be redirected to their detailed page which will provide you with information, tutorials and exercises.

On the footer in the far bottom you will find links redirecting you to essential websites related to Android development.

 Hogeschool van Amsterdam

**Material Design**  
Palettes  
Material

**Android**  
Android Studio  
Developers  
Blog

**Google**  
Developers  
Developers API

<http://www.android-development.online/>

# Experiences

- The learning environment with the tasks helps the students to learn.
- The learning environment motivates the students to learn.
- Building the learning tasks is very time-consuming.

## Reference list

van Merriënboer, J. J., & Kirschner, P. A. (2017). *Ten Steps to Complex Learning: A Systematic Approach to Four-Component Instructional Design* (Third Edition ed.). New York: Routledge.

Thank you for your attention

