

# Writing better Behat tests

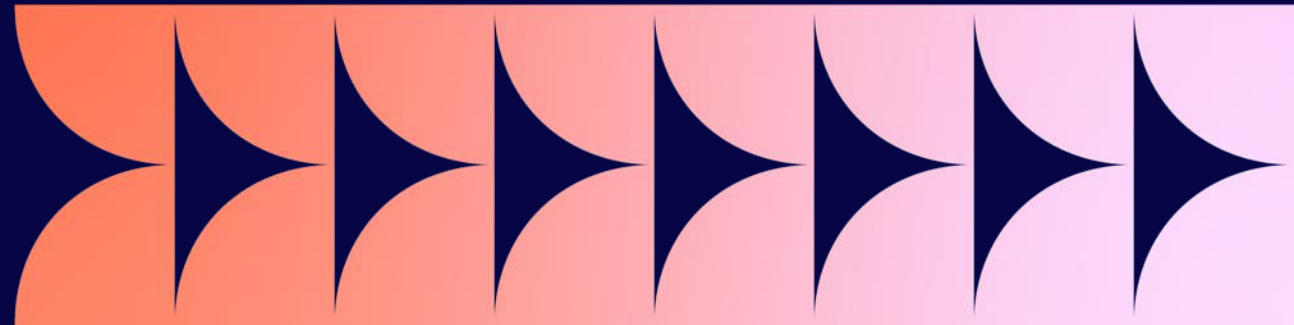
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# Writing better Behat tests

|   |                                       |
|---|---------------------------------------|
| 1 | Behat overview                        |
| 2 | Good tests in general                 |
| 3 | Common mistakes in Moodle Behat tests |
| 4 | Good practices                        |
| 5 | Summary                               |

# Behat overview

# A good example

Adapted from `question/format/xml/tests/behat/import_export.feature`

```
@qformat @qformat_xml
```

```
Feature: Test importing questions from Moodle XML format.
```

```
In order to reuse questions
```

```
As a teacher
```

```
I need to be able to import them in XML format.
```

```
@javascript @_file_upload
```

```
Scenario: import some multiple choice questions from Moodle XML format
```

```
Given the following "courses" exist:
```

| fullname    | shortname |
|-------------|-----------|
| Test Course | TC100     |

```
And the following "users" exist:
```

| username | teacher |
|----------|---------|
|----------|---------|

```
And the following "course enrolments" exist:
```

| user    | course | role           |
|---------|--------|----------------|
| teacher | TC100  | editingteacher |

```
When I am on the "Course 1" "core_question > course question import" page logged in as "teacher"
```

```
And I set the field "id_format_xml" to "1"
```

```
And I upload "question/format/xml/tests/fixtures/multichoice.xml" file to "Import" filemanager
```

```
And I press "Import"
```

```
Then I should see "Parsing questions from import file."
```

```
And I should see "Importing 1 questions from file"
```

```
And I should see "What language is being spoken?"
```

# About Behat

- ▶ Follows a simple script
  - written in 'English'
- ▶ Interacts with Moodle like a user would
  - most like a screen-reader
- ▶ Works in a separate Moodle install
  - which starts empty for each scenario
- ▶ Checks functionality, not visuals

How Behat works?

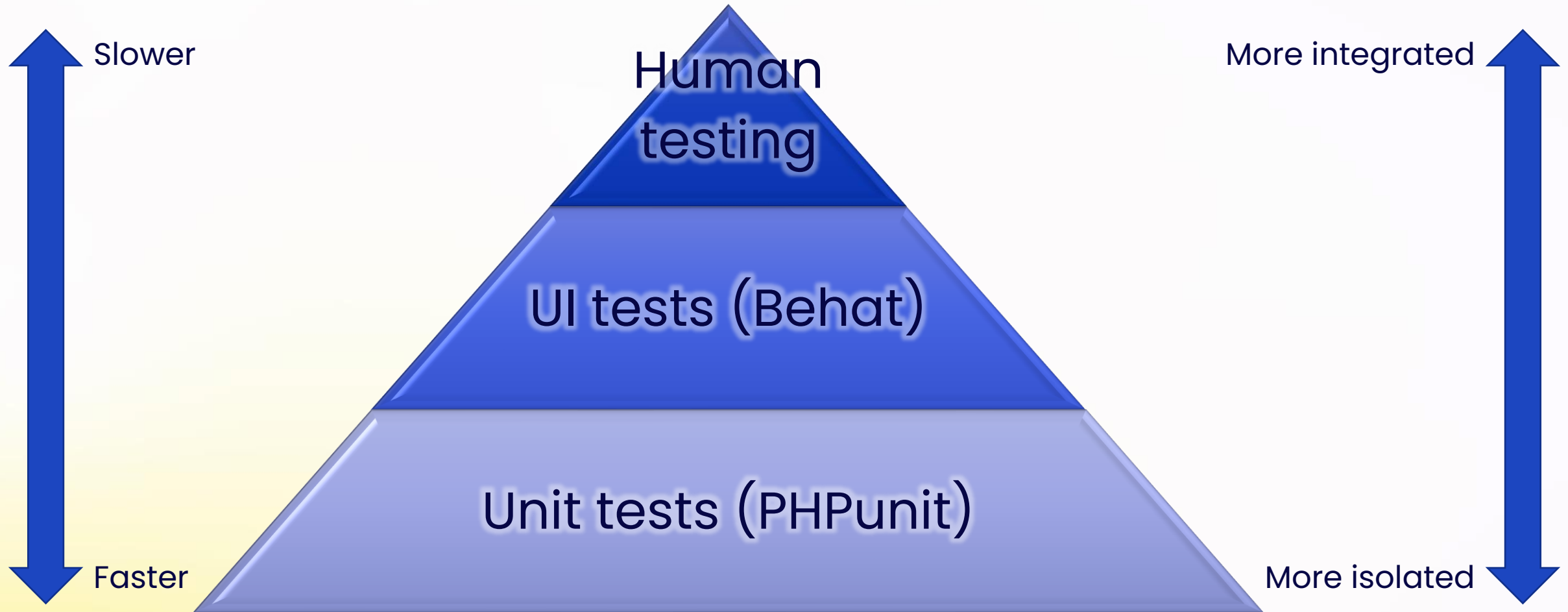
Let's not go there!



# Behat getting started

- ▶ If you are already set up for Moodle development
  - If not, see [Set up your Moodle Development Environment](#) on Moodle Academy
  
- ▶ Then [Running acceptance tests](#)
  1. Add some lines to config.php
  2. Install Selenium
  3. Execute `php admin/tool/behat/cli/init.php`
  4. Run a test!

# The test pyramid



# Good tests in general



# 4-phase test pattern

See, for example, <http://xunitpatterns.com/Four%20Phase%20Test.html>

- ▶ Setup
- ▶ Execute
- ▶ Verify
- ▶ Clean-up ← not needed in Moodle

# A good example

Adapted from question/format/xml/tests/behat/import\_export.feature

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@qformat @qformat_xml
```

```
Feature: Test importing questions from Moodle XML format.
```

```
In order to reuse questions
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As a teacher
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I need to be able to import them in XML format.
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```
@javascript @_file_upload
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Scenario: import some multiple choice questions from Moodle XML format
```

```
Given the following "courses" exist:
```

| fullname    | shortname |
|-------------|-----------|
| Test Course | TC100     |

```
And the following "users" exist:
```

| username | teacher |
|----------|---------|
|----------|---------|

```
And the following "course enrolments" exist:
```

| user    | course | role           |
|---------|--------|----------------|
| teacher | TC100  | editingteacher |

```
When I am on the "Course 1" "core_question > course question import" page logged in as "teacher"
```

```
And I set the field "id_format_xml" to "1"
```

```
And I upload "question/format/xml/tests/fixtures/multichoice.xml" file to "Import" filemanager
```

```
And I press "Import"
```

```
Then I should see "Parsing questions from import file."
```

```
And I should see "Importing 1 questions from file"
```

```
And I should see "What language is being spoken?"
```

# Good tests

- Test one thing
- Make it obvious what is being tested
- Make it obvious what the expected behaviour is
- Are well organised
  - Plugins -> Features -> Scenarios

# Bad tests

- Are opaque
- Are fragile
- Are slow

# A bad example

Adapted from mod/openstudio/tests/behat/content\_block\_socical.feature

Feature: Open Studio notifications

In order to track activity on content I am interested in

As a student

I want receive notifications about my posts and comments

Background:

Given the following "users" exist:

| username | firstname | lastname | email            |
|----------|-----------|----------|------------------|
| teacher1 | Teacher   | 1        | teacher1@asd.com |
| teacher2 | Teacher   | 1        | teacher1@asd.com |
| student1 | Student   | 1        | student1@asd.com |
| student2 | Student   | 2        | student2@asd.com |

And the following "courses" exist:

| fullname | shortname | category |
|----------|-----------|----------|
| Course 1 | C1        | 0        |

And the following "course enrolments" exist:

| user     | course | role           |
|----------|--------|----------------|
| teacher1 | C1     | editingteacher |
| teacher2 | C1     | editingteacher |
| student1 | C1     | student        |
| student2 | C1     | student        |

And the following open studio "instances" exist:

| course | name             | description              | grouping | groupmode | pinboard | idnumber | tutorroles     |
|--------|------------------|--------------------------|----------|-----------|----------|----------|----------------|
| C1     | Demo Open Studio | Notification description | GI1      | 1         | 99       | OS1      | editingteacher |

And all users have accepted the plagiarism statement for "OS1" openstudio

Given I am on the "Demo Open Studio" "openstudio activity" page logged in as "student1"

And I follow "Add new content"

And I set the following fields to these values:

|                 |             |
|-----------------|-------------|
| id_visibility_3 | 1           |
| Title           | Module post |
| Description     | Module post |

And I press "Save"

And I follow "My Content"

And I follow "Add new content"

And I set the following fields to these values:

|                 |               |
|-----------------|---------------|
| id_visibility_3 | 1             |
| Title           | Module post 1 |
| Description     | Module post 1 |

And I press "Save"

# A bad example continued

Adapted from mod/openstudio/tests/behat/content\_block\_socical.feature

```
Scenario: Interactive emoticons in content block social
  When I am on the "Demo Open Studio" "openstudio activity" page logged in as "teacher1"
  And I wait until the page is ready
  # The emoticons should be the gray icon when user doesn't react it.
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_5']//span[contains(., '')]" "xpath_element" should exist
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_5']//img[contains(@src, 'inspiration_grey_rgb_32px')]" "xpath_element" should exist
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_4']//span[contains(., '')]" "xpath_element" should exist
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_4']//img[contains(@src, 'participation_grey_rgb_32px')]" "xpath_element" should exist
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_2']//span[contains(., '')]" "xpath_element" should exist
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_2']//img[contains(@src, 'favourite_grey_rgb_32px')]" "xpath_element" should exist
  Then I click on "Module post 1" "link"
  And I wait until the page is ready
  And I click on "0 Favourites" "link"
  And I click on "0 Smiles" "link"
  And I click on "0 Inspired" "link"
  And I wait until the page is ready
  And I am on the "Demo Open Studio" "openstudio activity" page
  # The emoticons should be the blue icon when user reacts it.
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_5']//span[contains(., '1')]" "xpath_element" should exist
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_5']//img[contains(@src, 'inspiration_rgb_32px')]" "xpath_element" should exist
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_4']//span[contains(., '1')]" "xpath_element" should exist
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_4']//img[contains(@src, 'participation_rgb_32px')]" "xpath_element" should exist
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_2']//span[contains(., '1')]" "xpath_element" should exist
  Then "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_2']//img[contains(@src, 'favourite_rgb_32px')]" "xpath_element" should exist
  Then I am on the "Demo Open Studio" "openstudio activity" page logged in as "student1"
  And I click on "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_5']//span[contains(., '1')]" "xpath_element"
  And I click on "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_4']//span[contains(., '1')]" "xpath_element"
  And I click on "//*[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_2']//span[contains(., '1')]" "xpath_element"
  Then I am on the "Demo Open Studio" "openstudio activity" page logged in as "teacher1"
  And I click on "Module post 1" "link"
  And I should see "2 Favourites"
  And I should see "2 Smiles"
  And I should see "2 Inspired"
```

# Common mistakes

in Moodle Behat tests

# Irrelevant navigation

Adapted from mod/quiz/tests/behat/editing\_add.feature in Moodle 3.2

```
# ...
```

```
And I log in as "teacher1"
```

```
And I follow "Course 1"
```

```
And I follow "Quiz 1"
```

```
And I navigate to "Edit quiz" node in "Quiz administration"
```

```
# ...
```



# Setting things up using the UI

Adapted from mod/openstudio/tests/behat/content\_block\_socical.feature

**Feature:** Open Studio notifications

In order to track activity on content I am interested in

As a student

I want receive notifications about my posts and comments

**Background:**

# ...

**Given** I am on the "Demo Open Studio" "openstudio activity" page logged in as "student1"

**And** I follow "Add new content"

**And** I set the following fields to these values:

|                 |             |  |
|-----------------|-------------|--|
| id_visibility_3 | 1           |  |
| Title           | Module post |  |
| Description     | Module post |  |

**And** I press "Save"

**And** I follow "My Content"

**And** I follow "Add new content"

**And** I set the following fields to these values:

|                 |               |  |
|-----------------|---------------|--|
| id_visibility_3 | 1             |  |
| Title           | Module post 1 |  |
| Description     | Module post 1 |  |

**And** I press "Save"

# ...

Slow

Fragile

Irrelevant

# Identifying things on-screen using XPath or CSS

Adapted from question/format/xml/tests/behat/import\_export.feature

```
Scenario: Interactive emoticons in content block social
```

```
# ...
```

```
# The emoticons should be the blue icon when user reacts it.
```

```
Then "//div[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_5']//span[contains(., '1')]" "xpath_element" should exist
```

```
Then "//div[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_5']//img[contains(@src, 'inspiration_rgb_32px')]" "xpath_element" should exist
```

```
Then "//div[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_4']//span[contains(., '1')]" "xpath_element" should exist
```

```
Then "//div[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_4']//img[contains(@src, 'participation_rgb_32px')]" "xpath_element" should exist
```

```
Then "//div[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_2']//span[contains(., '1')]" "xpath_element" should exist
```

```
Then "//div[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_2']//img[contains(@src, 'favourite_rgb_32px')]" "xpath_element" should exist
```

```
Then I am on the "Demo Open Studio" "openstudio activity" page logged in as "student1"
```

```
And I click on "//div[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_5']//span[contains(., '1')]" "xpath_element"
```

```
And I click on "//div[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_4']//span[contains(., '1')]" "xpath_element"
```

```
And I click on "//div[@class='openstudio-grid-item'][1]//span[@id='content_view_icon_2']//span[contains(., '1')]" "xpath_element"
```

```
Then I am on the "Demo Open Studio" "openstudio activity" page logged in as "teacher1"
```

```
# ...
```

Fragile

Unclear

# Long rambling tests

question/type/pmatch/tests/behat/basic\_test.feature

- ▶ Huge time-waste if the failure is at the end
- ▶ Good Scenarios each test one thing
  - Then the failure message tells you what's broken

```
Scenario: Create, edit then preview a pattern match question.
When I am on the "Course 1" "core_question > course question bank" page logged in as teacher
# Create a new question.
And I add a "Pattern match" question filling the form with:
| Question name | My first pattern match question |
| Question text | Listen, translate and write |
| id_usecase | Yes, case must match |
| id_allowsubscript | Yes |
| id_allowsuperscript | Yes |
| id_forcelength | warn that answer is too long and invite resposdee to shorten it |
| id_applydictionarycheck | Do not check spelling of student |
| id_sencedividers | ?! |
| id_converttospace | ;: |
| id_synonymsdata_0_word | any |
| id_synonymsdata_0_synonyms | "testing\|one\|two\|three\|four" |
| Answer 1 | match (testing one two three four) |
| id_fraction_0 | 100% |
| id_feedback_0 | Well done! |
| id_otherfeedback | Sorry, no. |
| Hint 1 | Please try again. |
| Hint 2 | Use a calculator if necessary. |
Then I should see "My first pattern match question"
# Checking that the next new question form displays user preferences settings.
When I press "Create a new question ..."
And I set the field "item_qtype_pmatch" to "1"
And I click on "Add" "button" in the "Choose a question type to add" "dialogue"
Then the following fields match these values:
| id_usecase | Yes, case must match |
| id_allowsubscript | Yes |
| id_allowsuperscript | Yes |
| id_forcelength | warn that answer is too long and invite resposdee to shorten it |
| id_applydictionarycheck | Do not check spelling of student |
| id_sencedividers | ?! |
| id_converttospace | ;: |
And I press "Cancel"

# Preview it. Test correct and incorrect answers.
And I am on the "My first pattern match question" "core_question > preview" page

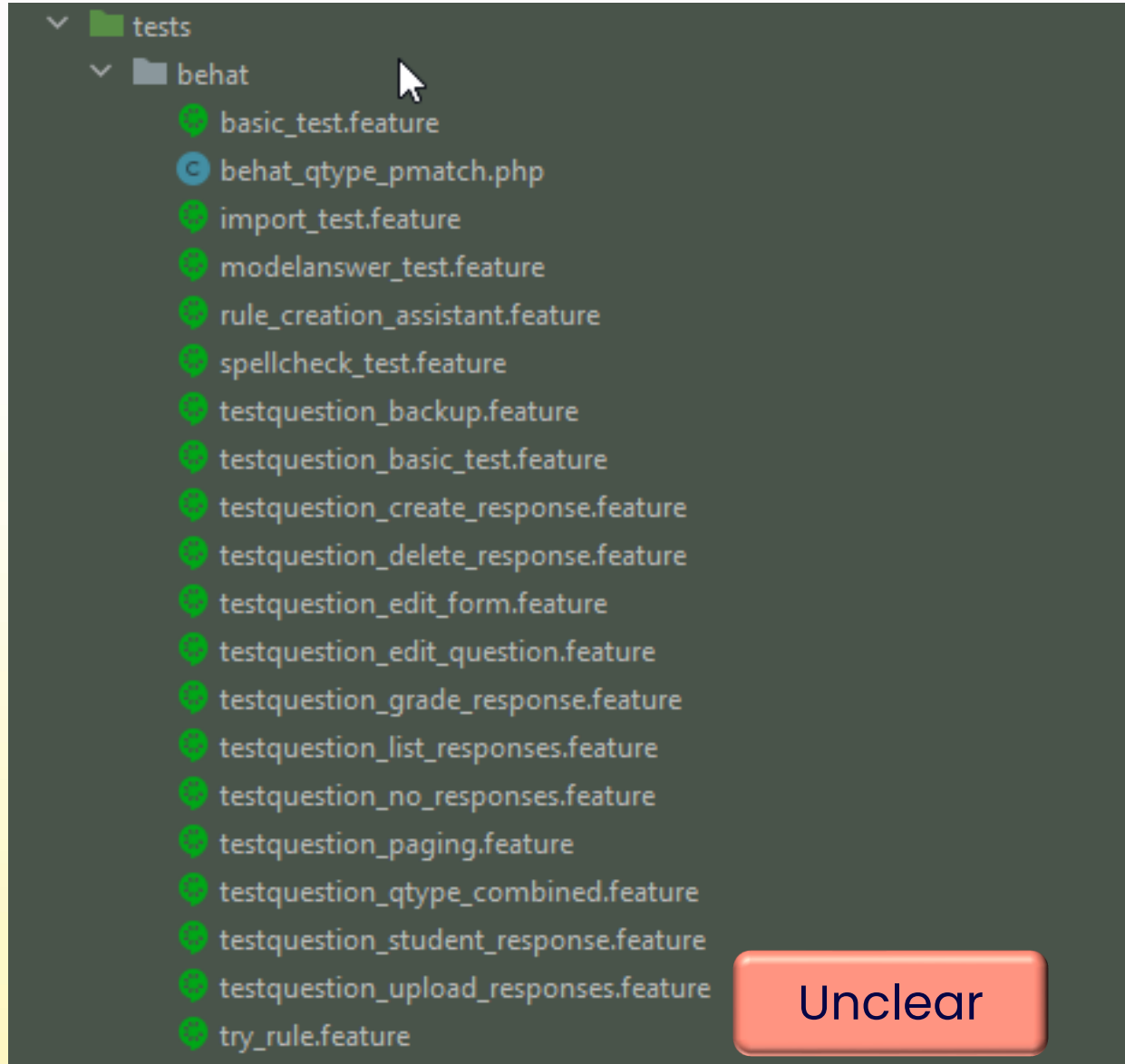
And I set the following fields to these values:
| How questions behave | Interactive with multiple tries |
| Marked out of | 3 |
| Marks | Show mark and max |
And I press "Start again with these options"
Then I should see "Listen, translate and write"
And the state of "Listen, translate and write" question is shown as "Tries remaining: 3"
When I set the field "Answer:" to "testing"
And I press "Check"
Then I should see "Sorry, no."
And I should see "Please try again."
When I press "Try again"
Then the state of "Listen, translate and write" question is shown as "Tries remaining: 2"
When I set the field "Answer:" to "testing one two three four"
And I press "Check"
Then I should see "Well done!"
Then the state of "Listen, translate and write" question is shown as "Correct"

# Backup the course and restore it.
When I log out
And I log in as "admin"
When I backup "Course 1" course using this options:
| Confirmation | Filename | test_backup.mbz |
When I restore "test_backup.mbz" backup into a new course using this options:
| Schema | Course name | Course 2 |
Then I should see "Course 2"
When I navigate to "Question bank" in current page administration
Then I should see "My first pattern match question"

# Edit the copy and verify the form field contents.
When I choose "Edit question" action for "My first pattern match question" in the question bank
Then the following fields match these values:
| Question name | My first pattern match question |
| Question text | Listen, translate and write |
| id_synonymsdata_0_word | any |
| id_synonymsdata_0_synonyms | "testing\|one\|two\|three\|four" |
| Answer 1 | match (testing one two three four) |
| id_fraction_0 | 100% |
| id_feedback_0 | Well done! |
| id_otherfeedback | Sorry, no. |
| Hint 1 | Please try again. |
| Hint 2 | Use a calculator if necessary. |
And I set the following fields to these values:
| Question name | Edited question name |
And I press "id_submitbutton"
Then I should see "Edited question name"
```

# Messy organisation

question/type/pmatch/tests/behat/



A screenshot of a file explorer interface showing a directory structure. The root directory is 'tests', which is expanded to show a sub-directory 'behat'. Inside 'behat', there is a long list of files, each with a green circular icon containing a white 'G' (likely representing a Git file). The files are:

- basic\_test.feature
- behat\_qtype\_pmatch.php
- import\_test.feature
- modelanswer\_test.feature
- rule\_creation\_assistant.feature
- spellcheck\_test.feature
- testquestion\_backup.feature
- testquestion\_basic\_test.feature
- testquestion\_create\_response.feature
- testquestion\_delete\_response.feature
- testquestion\_edit\_form.feature
- testquestion\_edit\_question.feature
- testquestion\_grade\_response.feature
- testquestion\_list\_responses.feature
- testquestion\_no\_responses.feature
- testquestion\_paging.feature
- testquestion\_qtype\_combined.feature
- testquestion\_student\_response.feature
- testquestion\_upload\_responses.feature
- try\_rule.feature

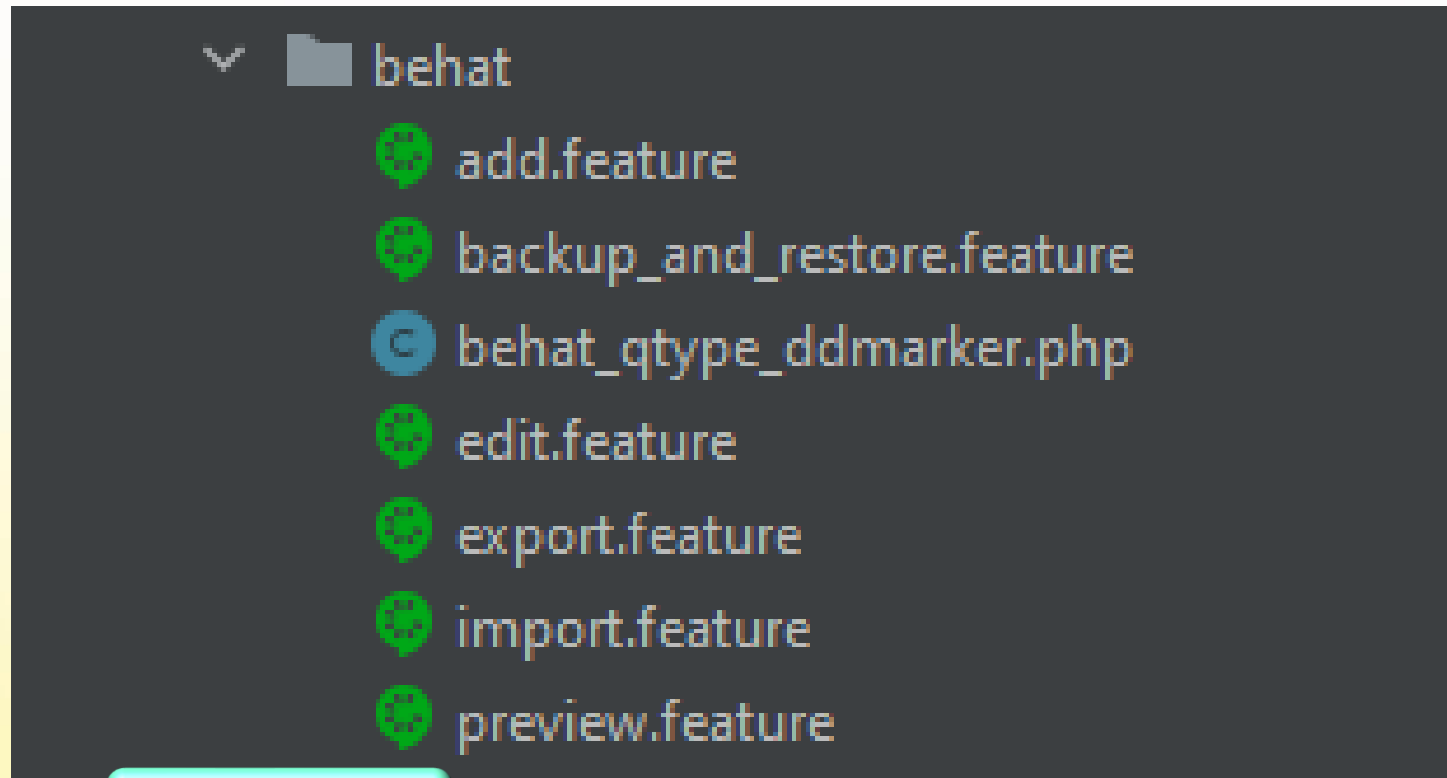
An orange button labeled 'Unclear' is positioned at the bottom right of the file explorer view.

# Good practices



# Organise and name things clearly

- › Naming things is hard
  - but getting it right helps everyone – including future you!



Organised

# Use Given, When and Then correctly

- ▶ Only test one thing per scenario
- ▶ Remember the four-phase test pattern

local/monitor/tests/behat/local\_monitor.feature

```
@ou @ou_vle @local @local_monitor
```

```
Feature: Check the monitor script, one of two that checks the server is working OK
```

```
In order to monitor the server system
```

```
As some back-end system component (supposing this script is still used, which we don't know)
```

```
I need to have the monitor script run
```

```
Scenario: Check monitor script
```

```
Given the following "courses" exist:
```

| fullname | shortname | format |
|----------|-----------|--------|
| Course 1 | C1        | topics |

```
And the following "activities" exist:
```

| activity | name | intro   | course | idnumber |
|----------|------|---|--------|----------|
| label    | L1   | <a href=" ../local/monitor/index.php?display=1">MonLink</a> | C1     | label1   |

```
When I log in as "admin"
```

```
And I am on "Course 1" course homepage
```

```
And I follow "MonLink"
```

```
Then I should see "All tests completed successfully"
```

Clear

# Important Given steps

› **Given** the following config values are set as admin:  
| showuseridentity | email,profile\_field\_oucu |

› **Given** the following "... " exist:

Extensible

› "... can be

- Standard entities like "user", "course", "activity", "course enrolments", ...
- Full list in lib/behat/classes/behat\_core\_generator.php
- You can extend this for your plugin



# Extending entity generation

From mod/quiz/tests/generator/behat\_mod\_quiz\_generator.php

Given the following "mod\_quiz > group overrides" exist:

| quiz      | group | attempts |
|-----------|-------|----------|
| Test quiz | G1    | 2        |

```
class behat_mod_quiz_generator extends behat_generator_base {  
  
    protected function get_creatable_entities(): array {  
        return [  
            'group overrides' => [  
                'singular' => 'group override',  
                'datagenerator' => 'override',  
                'required' => ['quiz', 'group'],  
                'switchids' => ['quiz' => 'quiz', 'group' => 'groupid'],  
            ],  
            'user overrides' => [  
                'singular' => 'user override',  
                'datagenerator' => 'override',  
                'required' => ['quiz', 'user'],  
                'switchids' => ['quiz' => 'quiz', 'user' => 'userid'],  
            ],  
        ];  
    }  
}
```

# Important When steps

- › When I am on the "Quiz 1" "mod\_quiz > Grades report" page
- › When I am on the "Intro" "page activity" page logged in as student
- › When I follow "Edit profile"
- › When I press "Save changes"
- › When I set the field "Question text" to "Edited question text."
- › When I set the following fields to these values:

|                   |                        |
|-------------------|------------------------|
| Question name     | AV question            |
| Type of recording | Customised audio/video |
- › When I click on "Student" "link" in the "View as" "block"

# Extending navigation

Adapted from question/tests/behat/behat\_core\_question.php

When I am on the "Course 1" "core\_question > course question bank" page

```
/**
 * Convert page names to URLs for steps like 'When I am on the "[identifier]" "[page type]" page'.
 *
 * Recognised page names are:
 * | pagetype           | name meaning           | description           |
 * | course question bank | Course name           | The question bank for a course |
 * | preview            | Question name         | The screen to preview a question |
 *
 * @param string $type identifies which type of page this is, e.g. 'Preview'.
 * @param string $identifier identifies the particular page, e.g. 'My question'.
 * @return moodle_url the corresponding URL.
 * @throws Exception with a meaningful error message if the specified page cannot be found.
 */
protected function resolve_page_instance_url(string $type, string $identifier): moodle_url {
    switch (strtolower($type)) {
        case 'course question bank':
            return new moodle_url('/question/edit.php',
                ['courseid' => $this->get_course_id($identifier)]);

        case 'preview':
            [$questionid, $otheridtype, $otherid] = $this->find_question_by_name($identifier);
            return new moodle_url('/question/bank/previewquestion/preview.php',
                ['id' => $questionid, $otheridtype => $otherid]);

        default:
            throw new Exception('Unrecognised core_question page type "' . $type . '"');
    }
}
```

# Important Then steps

- ▶ Then I should see "Embedded question progress for Course 1"
- ▶ Then I should not see "Fill in the Blanks"
- ▶ Then "Page 3" "link" should exist
- ▶ Then "Equation editor" "button" should be visible
  
- ▶ Then the field "Describe this image" matches value "Awesome!"
- ▶ Then the following fields match these values:
  
- ▶ Then "Student 1" row "Username" column of "generaltable" table should contain "student1"

# More Than steps

Extensible

- ▶ Then I should see "Frog" in the "activity" "core\_course > Activity chooser tab"
- ▶ Then I should see "Incorrect" in the "student2" "table\_row"
- ▶ Then "Delete" "button" should not exist in the "Confirm" "dialogue"
- ▶ Then "Unread posts" "link" in the "Forum1" "list\_item" should be visible

- various things like link, button, list item, dialogue, block, region, ...
- full list in lib/behat/classes/partial\_named\_selector.php
- can be extended for your plugin.
- a kitten dies any time you use "css\_element" or "xpath\_element"



# Extending selectors

From course/tests/behat/behat\_course.php

... in the "activity" "core\_course > Activity chooser tab"

```
class behat_course extends behat_base {  
    public static function get_partial_named_selectors(): array {  
        return [  
            new behat_component_named_selector(  
                'Activity chooser screen', [  
                    "%core_course/activityChooser%/*[@data-region=%locator%][contains(concat(' ', @class, ' '), ' carousel-item ')]"  
                ]  
            ),  
            new behat_component_named_selector(  
                'Activity chooser tab', [  
                    "%core_course/activityChooser%/*[@data-region=%locator%][contains(concat(' ', @class, ' '), ' tab-pane ')]"  
                ]  
            ),  
        ];  
    }  
}
```

# Completely custom steps

Example adapted from mod/quiz/tests/behat/behat\_mod\_quiz.php

- ▶ A great option when appropriate
  - Other extensibility makes it less necessary
  - Ensure the step text clearly belongs to your plugin

```
Given quiz "Quiz 1" contains the following questions:  
| question | page |  
| TF1      | 1    |
```

```
/**  
 * Put the specified questions on the specified pages of a given quiz.  
 *  
 * The first row should be column names:  
 * | question | page | maxmark |  
 *  
 * @param string $quizname the name of the quiz to add questions to.  
 * @param TableNode $data information about the questions to add.  
 *  
 * @Given quiz :quizname contains the following questions:  
 */  
public function quiz_contains_the_following_questions($quizname, TableNode $data) {  
    // ... Lots of complex code ...  
}
```

Fast

Robust

# Summary



# Summary

- Remember everything you already know about testing
- Learn by doing and looking at examples (and docs)
  - but judge what you are looking at before you copy it
- Remember the good practices and avoid the bad ones
- Get support from other people
  - <https://moodledev.io/general/channels#developer-chat>
- There is lots you could learn, but you don't need to learn it all at once
  - you can get a long way with just some basic steps
  - simple is good!