Identifying Predictors for Code Highlighting Skills

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Open-Minded

CSE

```go
func (d *glusterfsDriver) saveState() {
    data, err := json.Marshal(d.volumes)
    if err != nil {
        logrus.WithField("statePath", d.statePath).Error(err)
        return
    }

    if err := ioutil.WriteFile(d.statePath, data, 0644); err != nil {
        logrus.WithField("savestate", d.statePath).Error(err)
    }
}

```

Identify all method calls!

```go
func (d *glusterfsDriver) saveState() {
    data, err := json.Marshal(d.volumes)
    if err != nil {
        logrus.WithField("statePath", d.statePath).Error(err)
        return
    }

    if err := ioutil.WriteFile(d.statePath, data, 0644); err != nil {
        logrus.WithField("savestate", d.statePath).Error(err)
    }
}

```

6 Method calls!

Project Goal

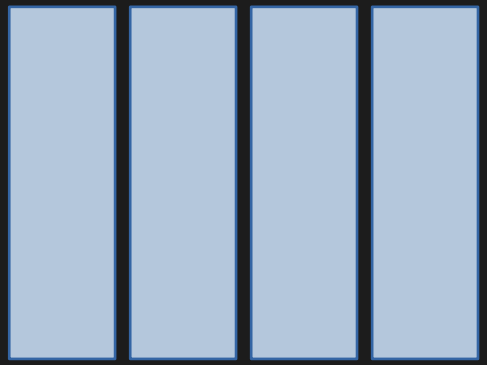
What is needed to become a competent programmer?

What are competencies?

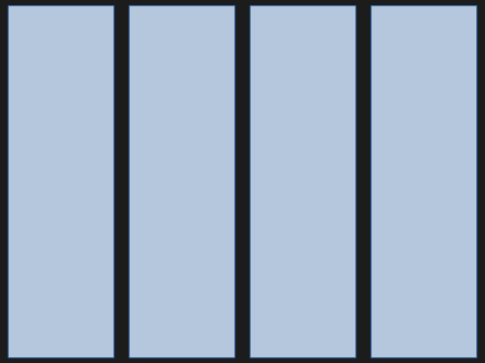
“context-specific cognitive dispositions that are acquired and needed to successfully cope with certain situations or tasks in specific domains”

Koeppen et al. 2008

How can competencies be described?



Structure Model



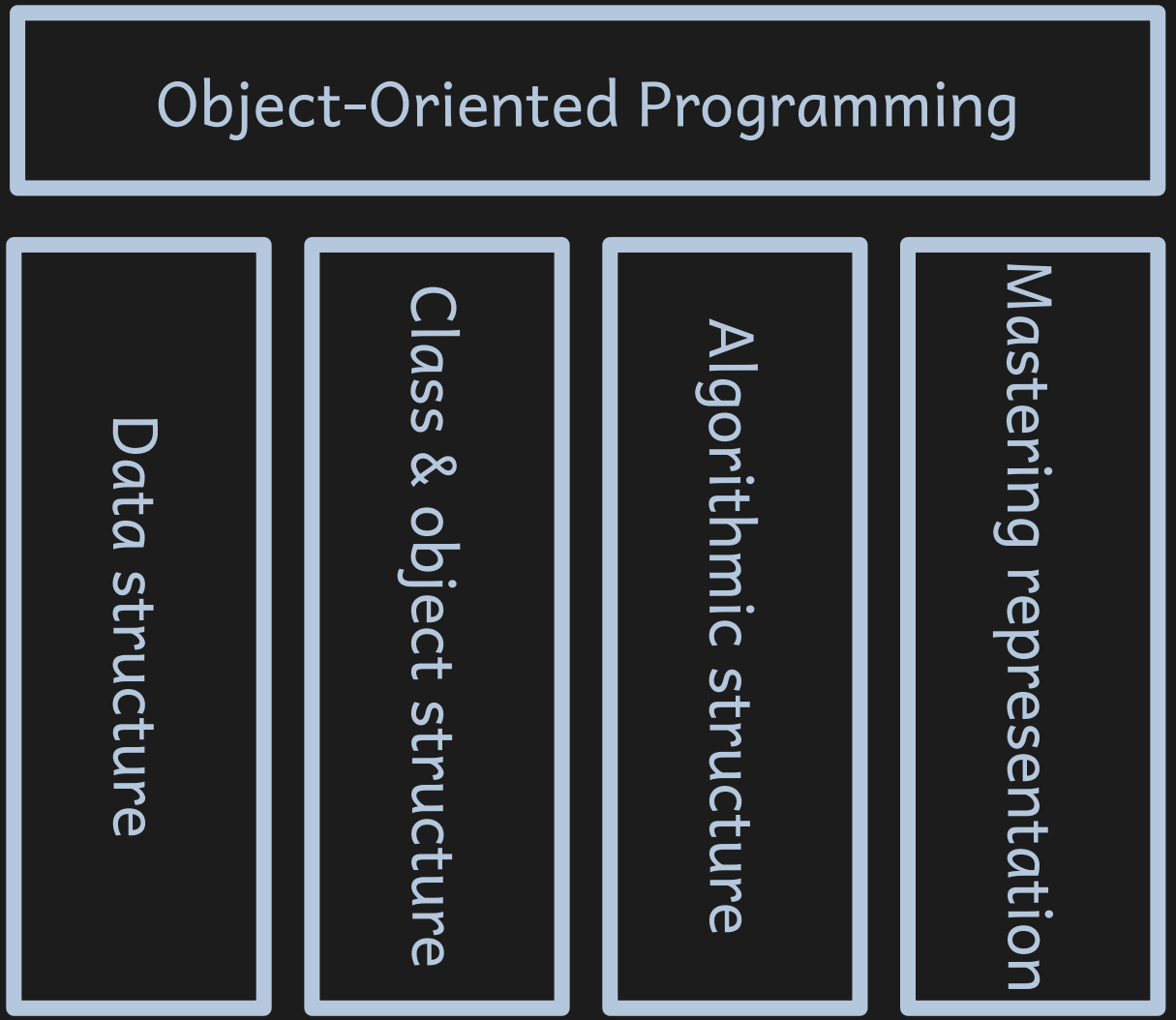
5	5	5	5
4	4	4	4
3	3	3	3
2	2	2	2
1	1	1	1

Structure Model

Level Model

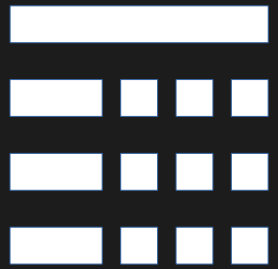
A competency structure model for object-oriented programming

Kramer et al. 2016



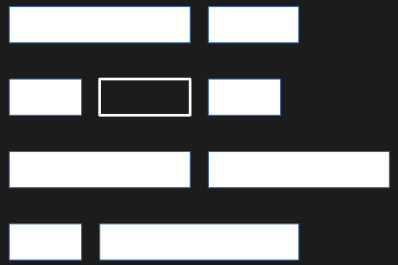
Which influence do competencies in the dimensions *class & object structure* and *mastering representation* have on the ability to identify concept in a given source code?

OOP Concepts



Multiple-Choice

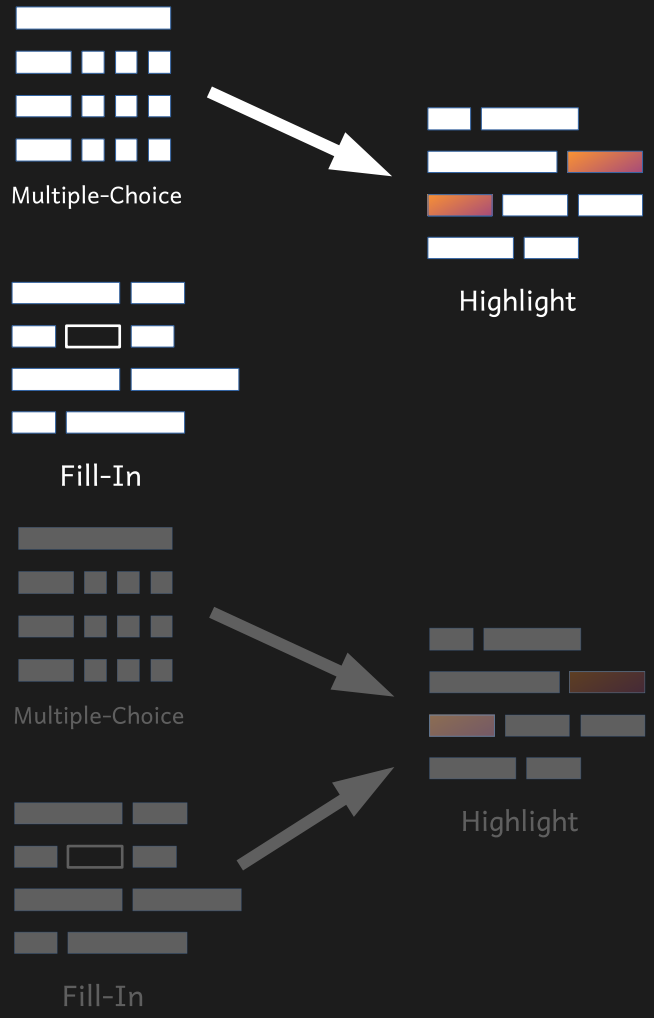
Java Syntax



Fill-In

Identify OOP in Java Snippets

Highlight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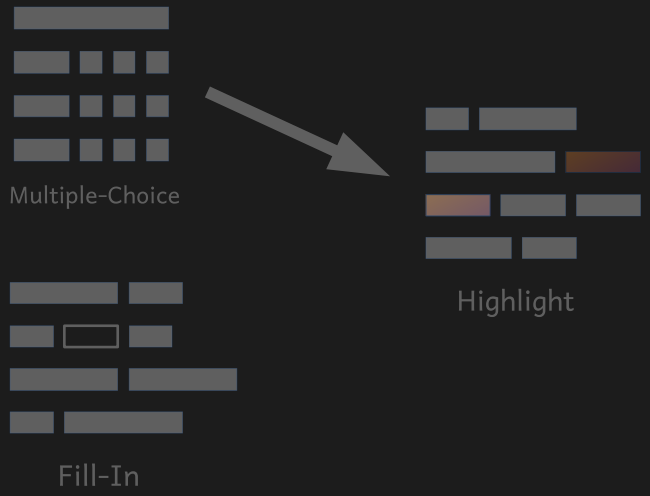
Fill-In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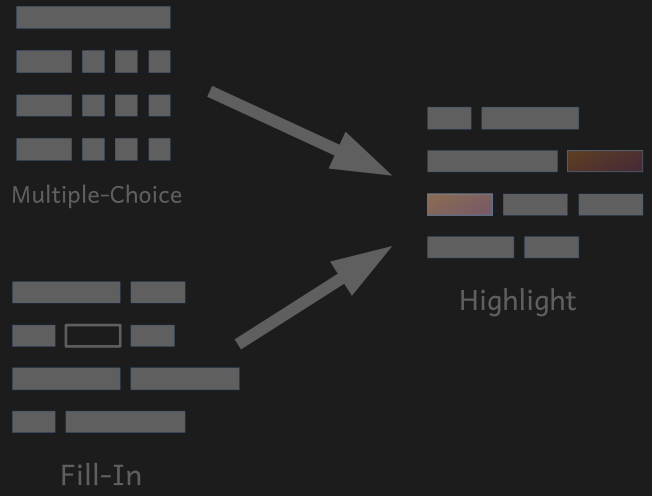
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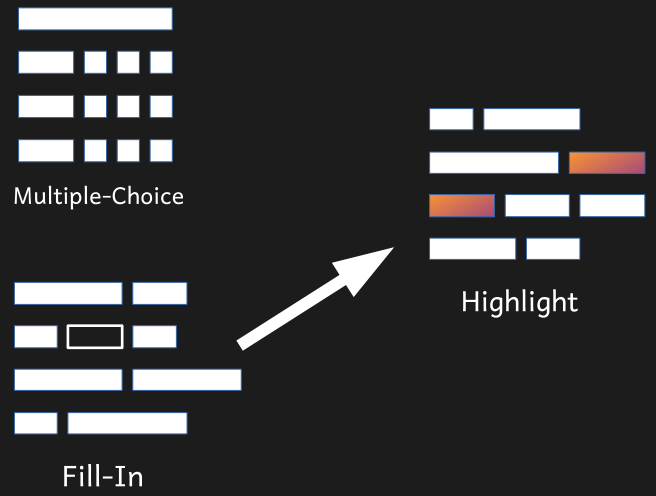
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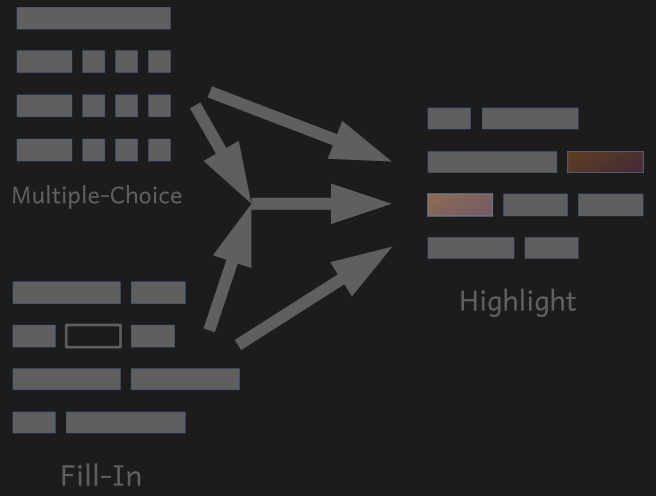
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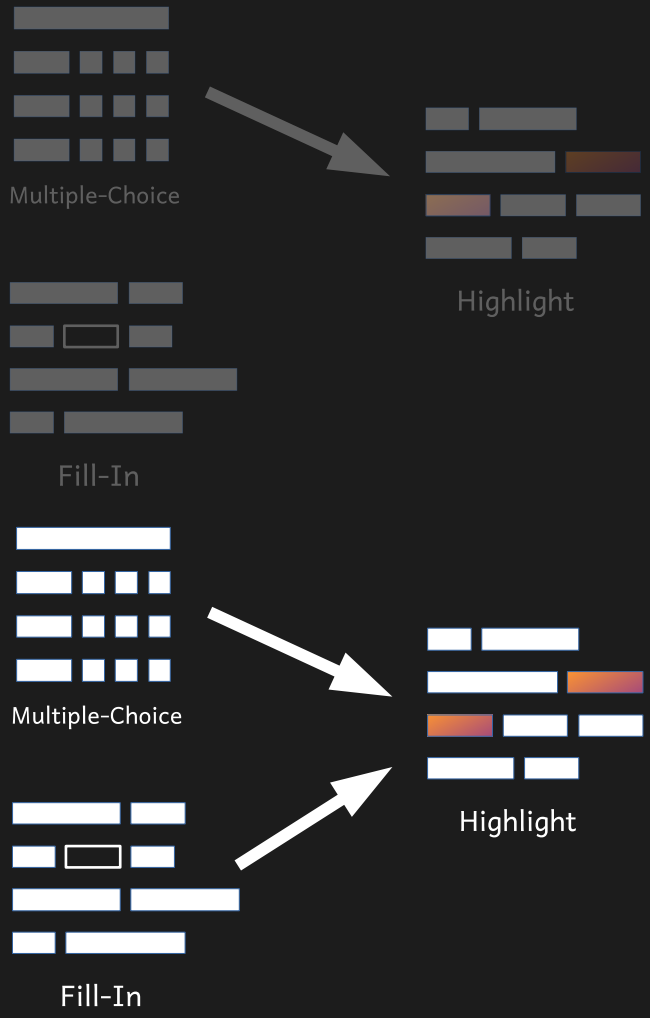
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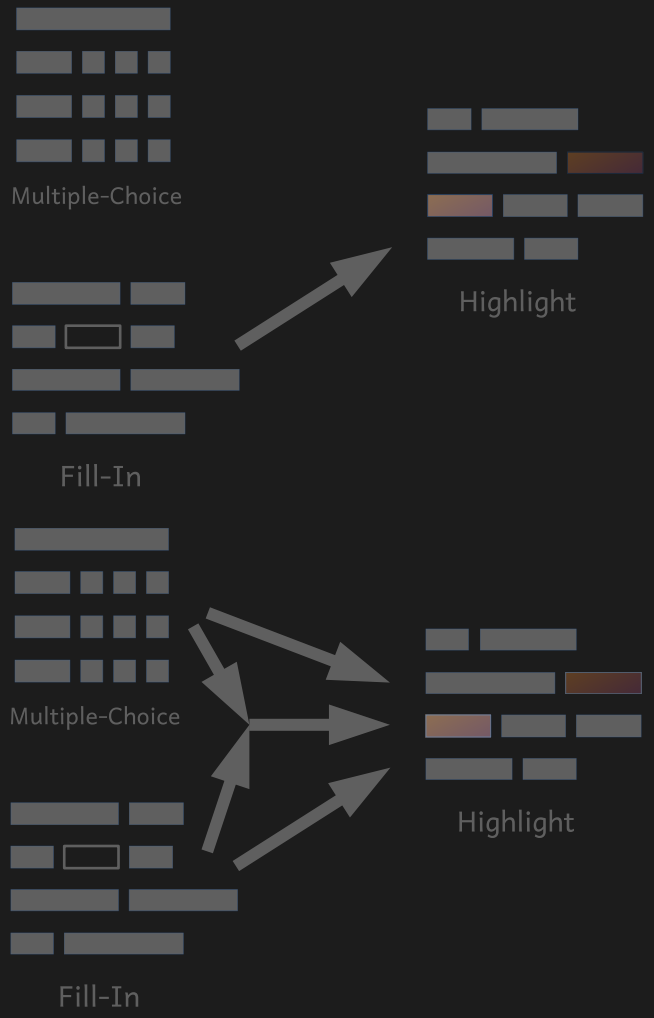
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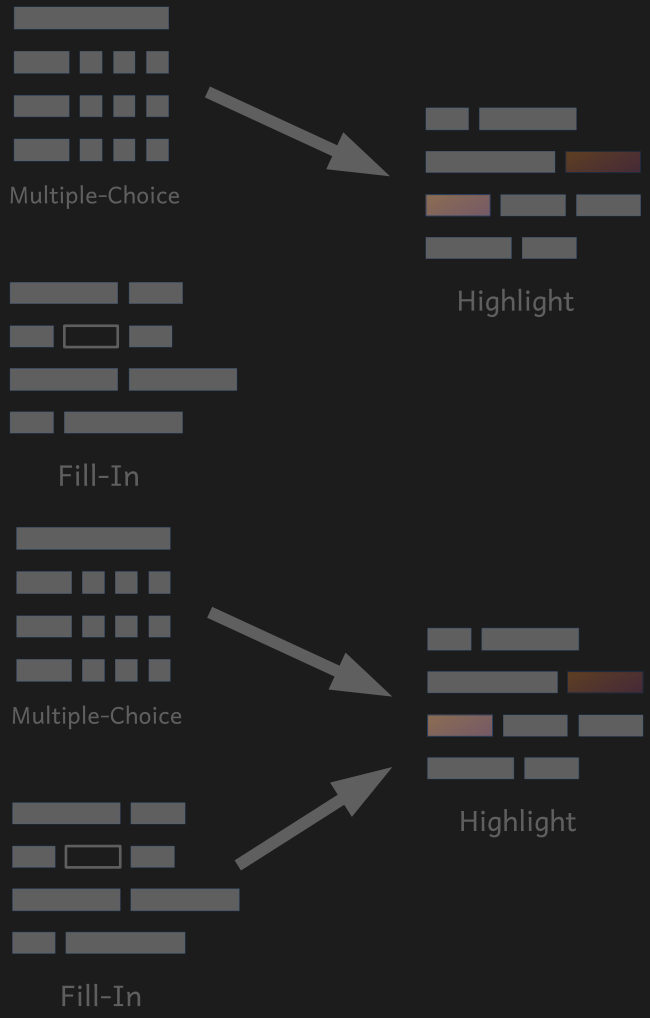
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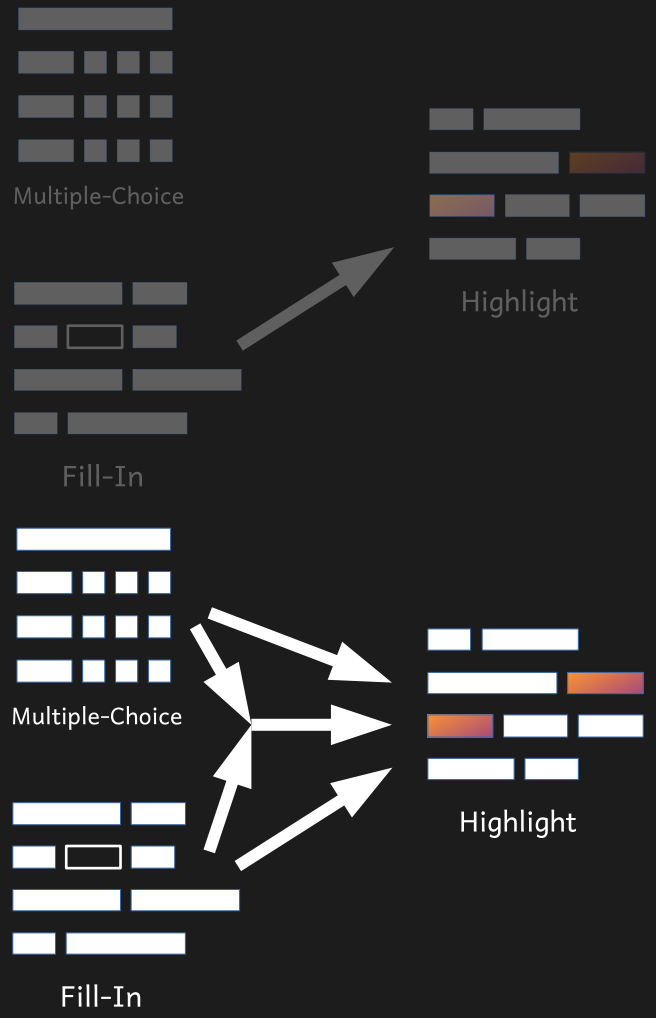
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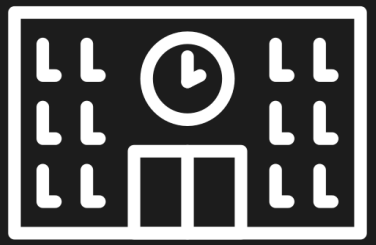
Fill-In

16

Schools



211

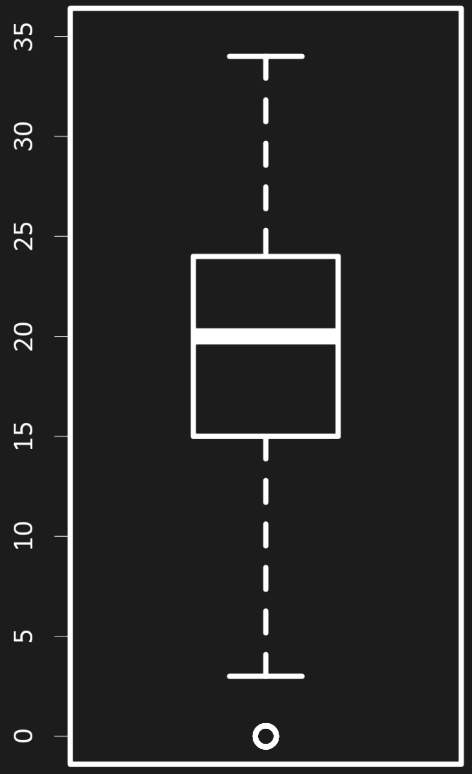
Students

55% 20% 25%

Ø 16.9 (SD = 1.95)

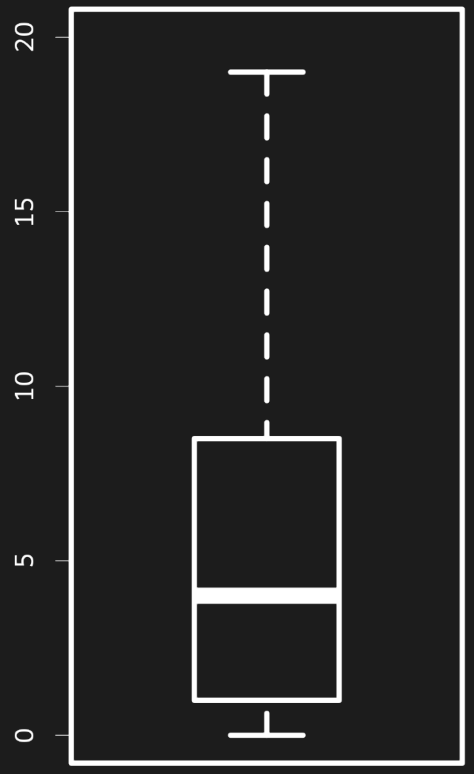
35x

Multiple-Choice



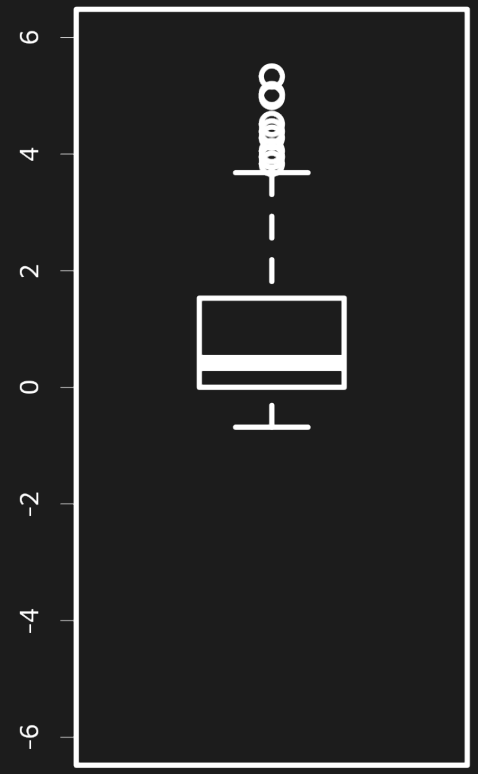
19x

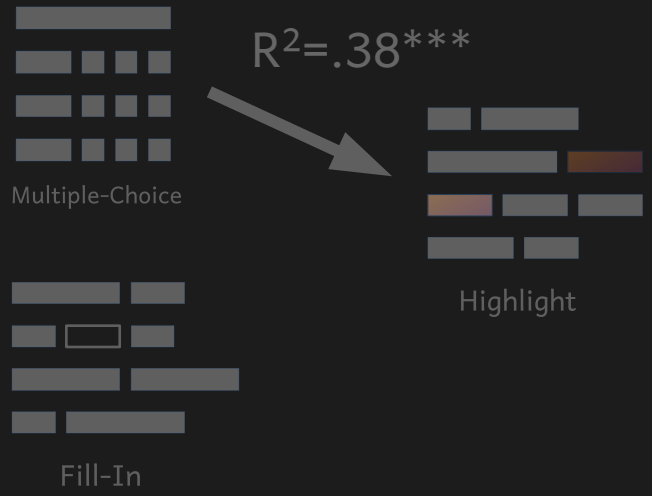
Fill-In

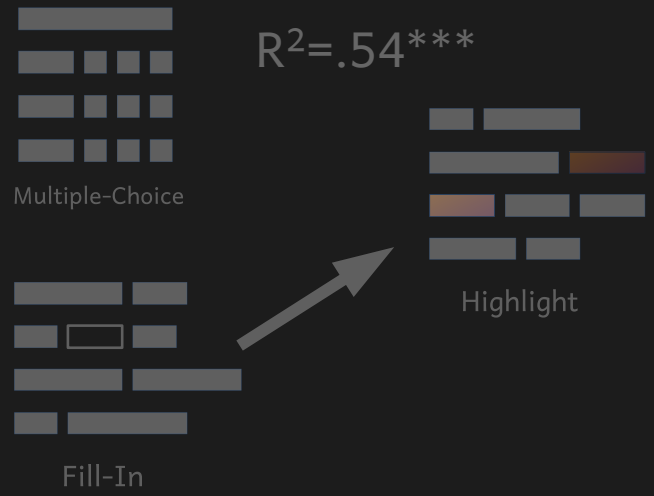


6x

Highlight




R^2=.38***
Multiple-Choice
Highlight
Fill-In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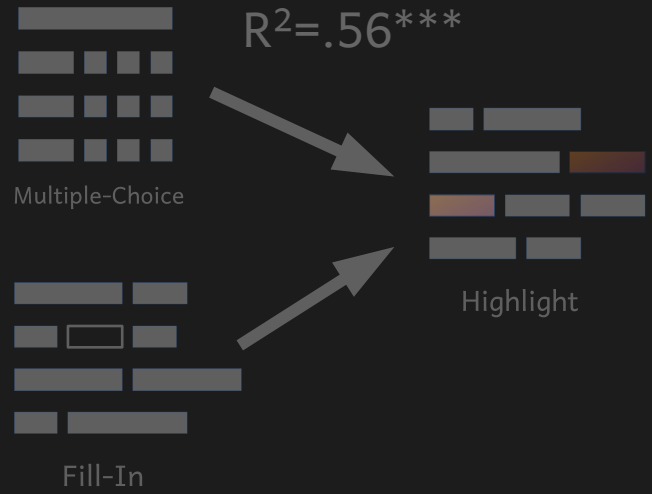
Fill-In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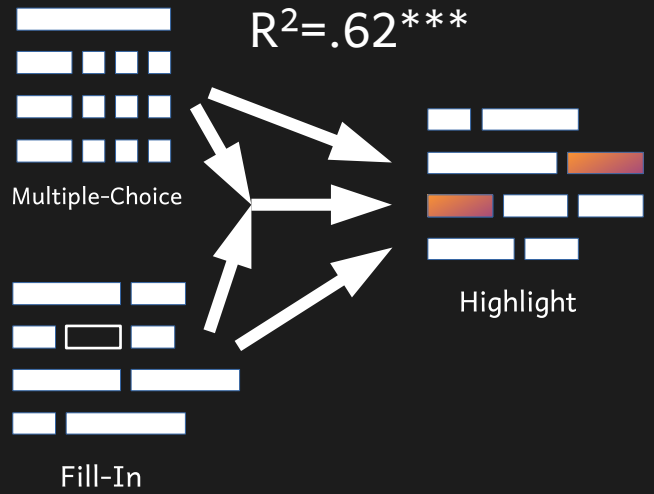
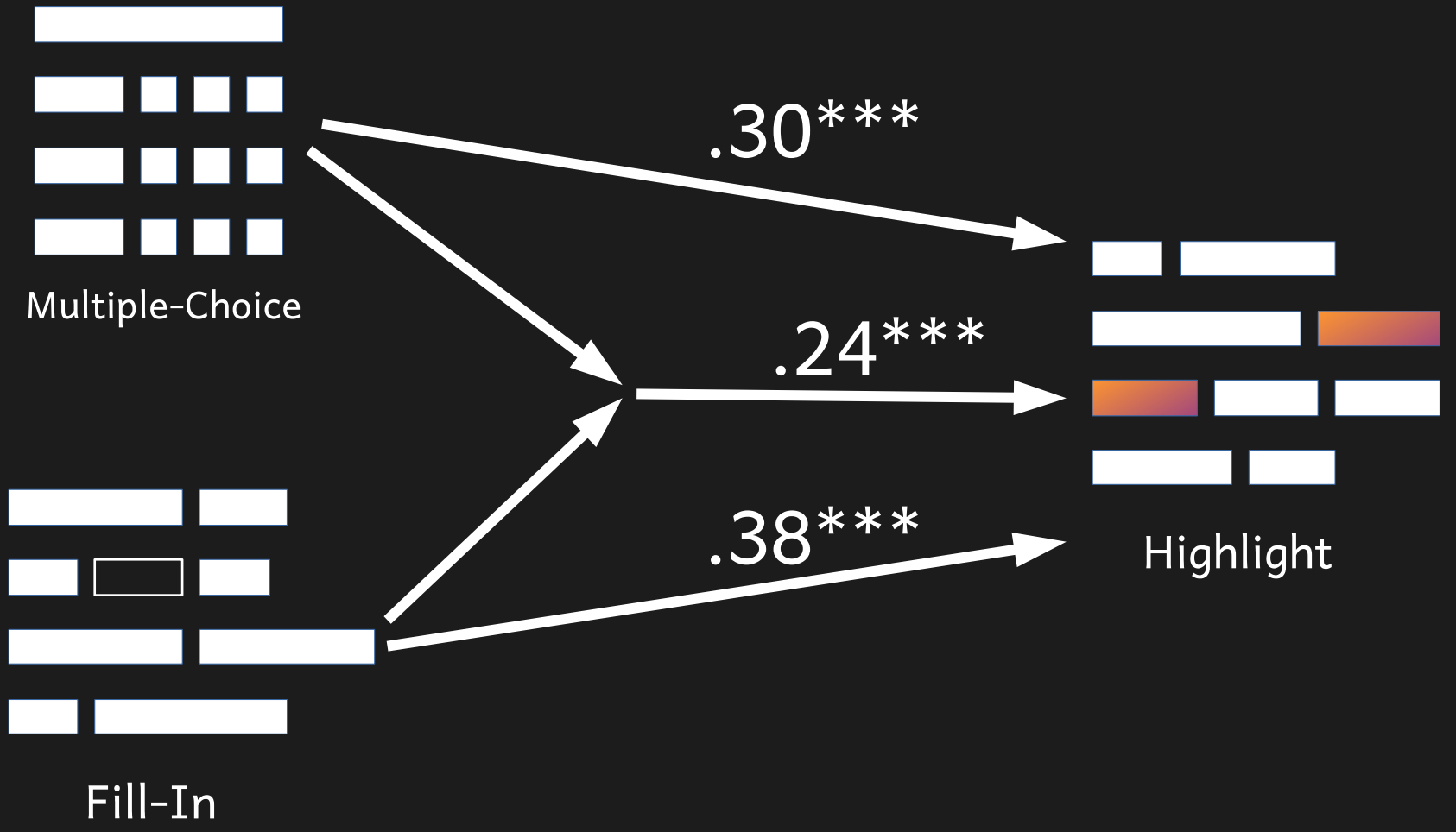
Multiple-Choice
Highlight
Fill-In


R^2=.62***
Multiple-Choice
Highlight
Fill-In


.30***
.24***
.38***
Multiple-Choice
Fill-In
Highlight

Implication

Students might understand OOP concepts and Syntax, but are struggling with interconnecting both areas and therefore could be unable to read and understand code

⚠ Caution: Due to violation of normal distribution our results are only valid for the presented sample. (Please replicate!)

Next Steps

- Does “objects first” or “objects later” influence the outcome?
- Can we replicate the results?
- Can students transfer their skills to new programming languages?

Graphics

- All emojis designed by OpenMoji – the open-source emoji and icon project. License: CC BY-SA 4.0

Literature

- Karoline Koeppen, Johannes Hartig, Eckhard Klieme, and Detlev Leutner. 2008. Current issues in competence modeling and assessment. Zeitschrift für Psychologie/Journal of Psychology 216, 2 (2008), 61–73.
- Matthias Kramer, Mike Barkmin, Torsten Brinda, and David Tobinski. 2018. Automatic Assessment of Source Code Highlighting Tasks: Investigation of Different Means of Measurement. In Proceedings of the 18th Koli Calling International Conference on Computing Education Research (Koli Calling '18). ACM, New York, NY, USA, Article 8, 10 pages. https://doi.org/10.1145/3279720.3279729
- Matthias Kramer, Peter Hubwieser, and Torsten Brinda. 2016. A Competency Structure Model of Object-Oriented Programming. In 2016 International Conference on Learning and Teaching in Computing and Engineering (LaTICE). 1–8. https://doi.org/10.1109/LaTiCE.2016.24
- Jeffrey N. Rouder, Christopher R. Engelhardt, Simon McCabe, and Richard D. Morey. 2016. Model comparison in ANOVA. Psychonomic Bulletin & Review 23, 6 (01 Dec 2016), 1779–1786. https://doi.org/10.3758/s13423-016-1026-5