Cognitive Loads and Training Success in a Video-based Online Training Course

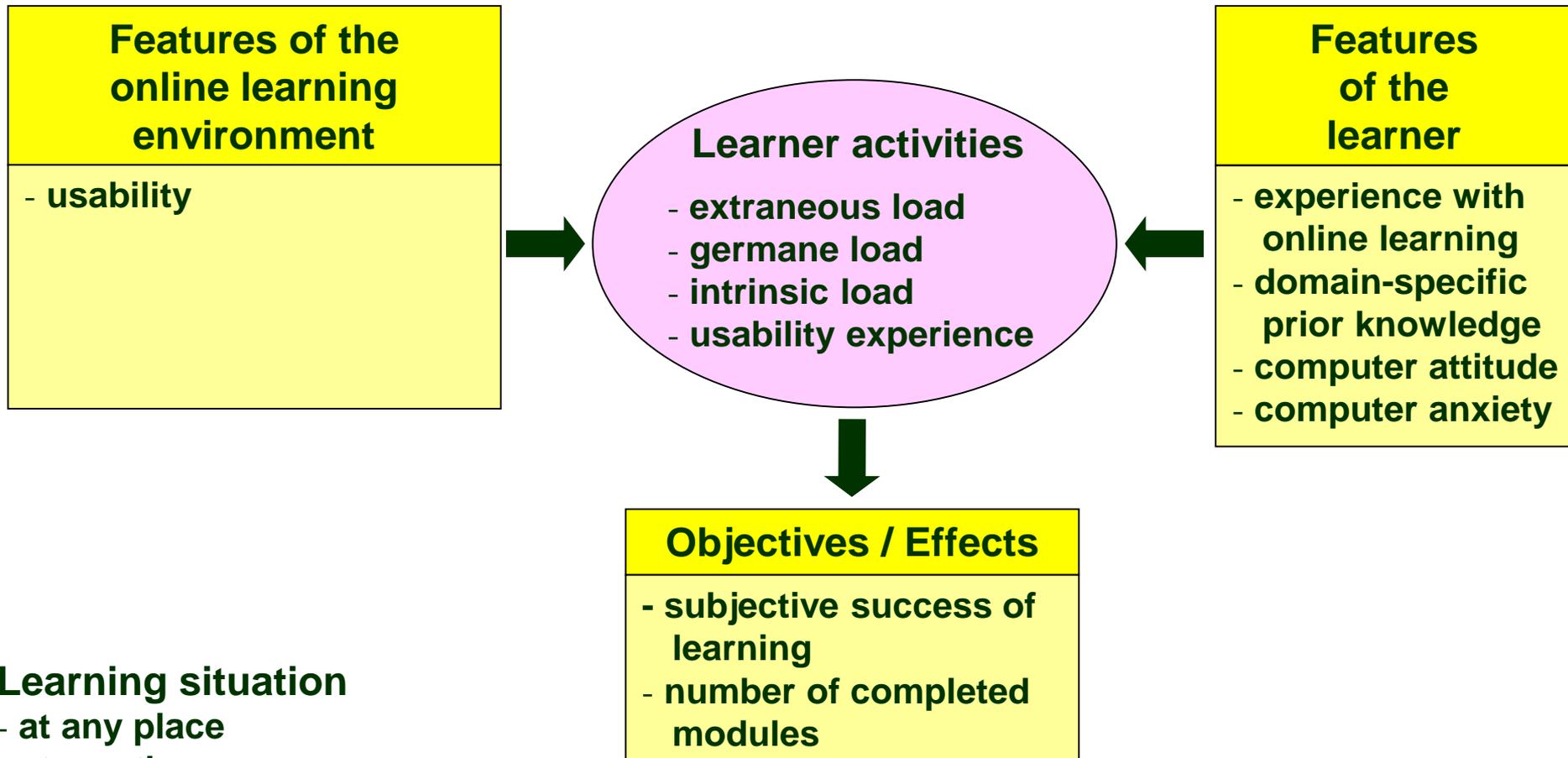Klaus D. Stiller and Annamaria Köster

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Introduction

- Online learning is established besides the traditional ways of learning and teaching (e.g., Allen & Seeman, 2016)

- Still existing problems
  - high dropout rates (e.g., Lee & Choi, 2011)
  - supporting students in successful learning (e.g., Jo, Park, Yoon, & Sung, 2016).

Introduction

Features of the online learning environment

- usability

Learner activities

- extraneous load
- germane load
- intrinsic load
- usability experience

Features of the learner

- experience with online learning
- domain-specific prior knowledge
- computer attitude
- computer anxiety

Objectives / Effects

- subjective success of learning
- number of completed modules

Learning situation
- at any place
- at any time
- online training course
- etc.

Research questions

1. Could the learner characteristics be used to model the learning process?

2. Could the learning process variables be used to model outcome variables?

3. Could the learner characteristics be used to directly model the outcome variables?

Research questions

Domain-specific prior knowledge

- computer usage, information processing, performance (e.g., Amadieu et al., 2009; McDonald & Stevenson, 1998)
- Expertise reversal effects / Expertise effects

Online learning experience

- knowledge about online learning portals and their usage, typical course processes, and adequate learning strategies
- performance, and course persistence (e.g., Dodd et al., 2009; Hachey et al., 2014; Lee & Choi 2011; Park & Choi, 2009)
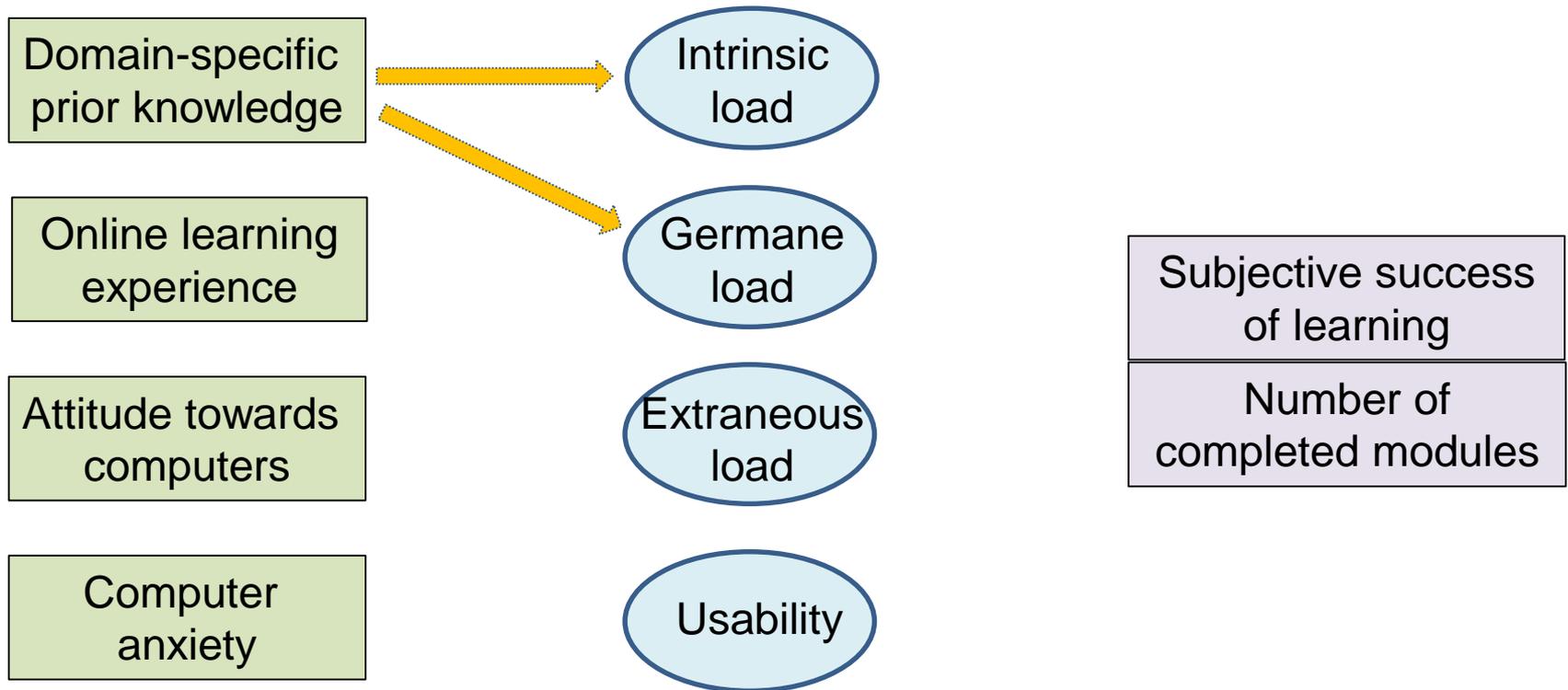
Attitude towards computers

- consist of affective, conative and cognitive components
- beliefs that are organized in topics (computer as an instrument for working and learning)
- performance, course usage, and persistence (e.g., Bernard et al., 2004; Stiller, 2009, 2015)
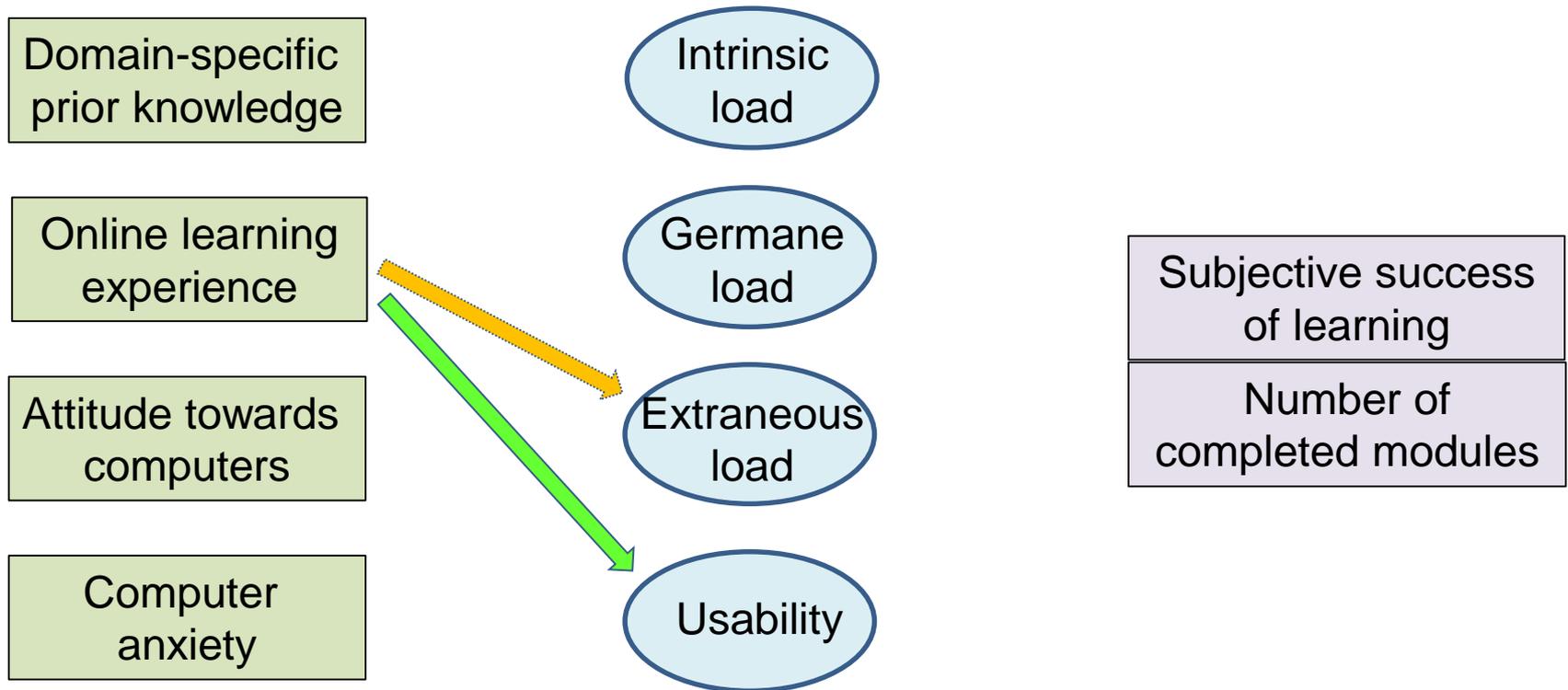
Computer anxiety

- comprises both cognitive and affective components such as feelings of anxiety and worrisome thoughts (Richter et al., 2010)
- performance and course usage (e.g., Hauser et al., 2012; Saadé & Kira, 2009; Sam et al., 2005)
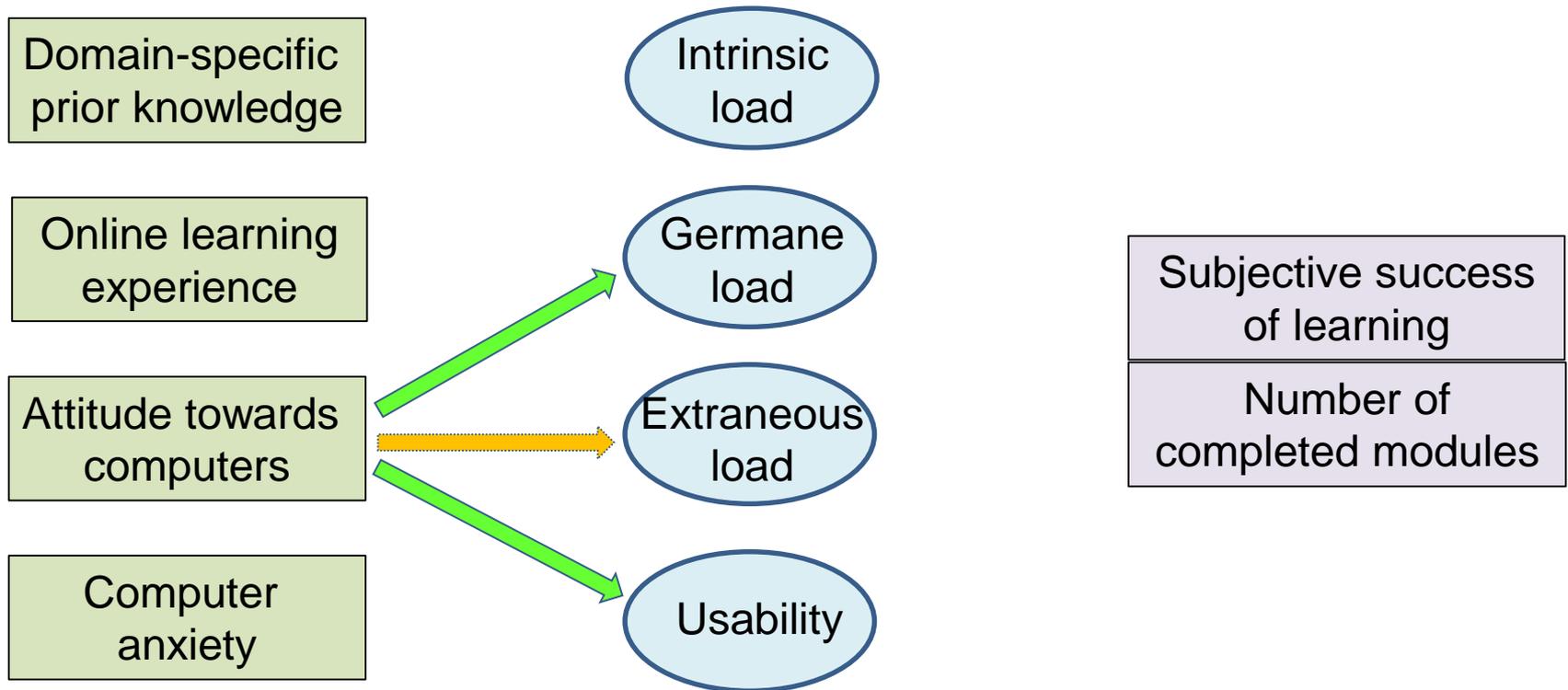
Research questions

Domain-specific prior knowledge

Online learning experience

Attitude towards computers

Computer anxiety

Intrinsic load

Germane load

Extraneous load

Usability

Subjective success of learning

Number of completed modules

Green arrows could be interpreted in the sense of positive correlations, orange arrows in the sense of negative correlations.

Research questions

Domain-specific prior knowledge

Online learning experience

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Computer anxiety

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Germane load

Extraneous load

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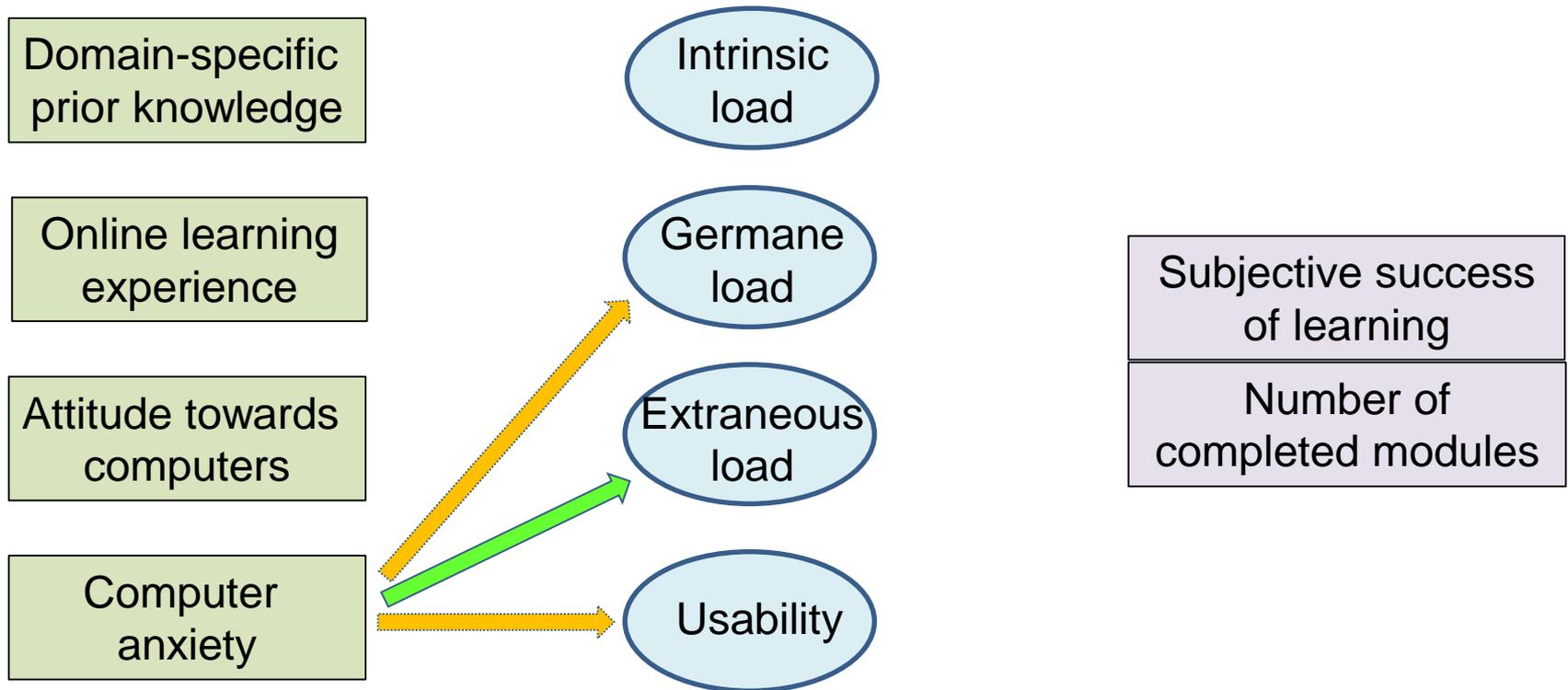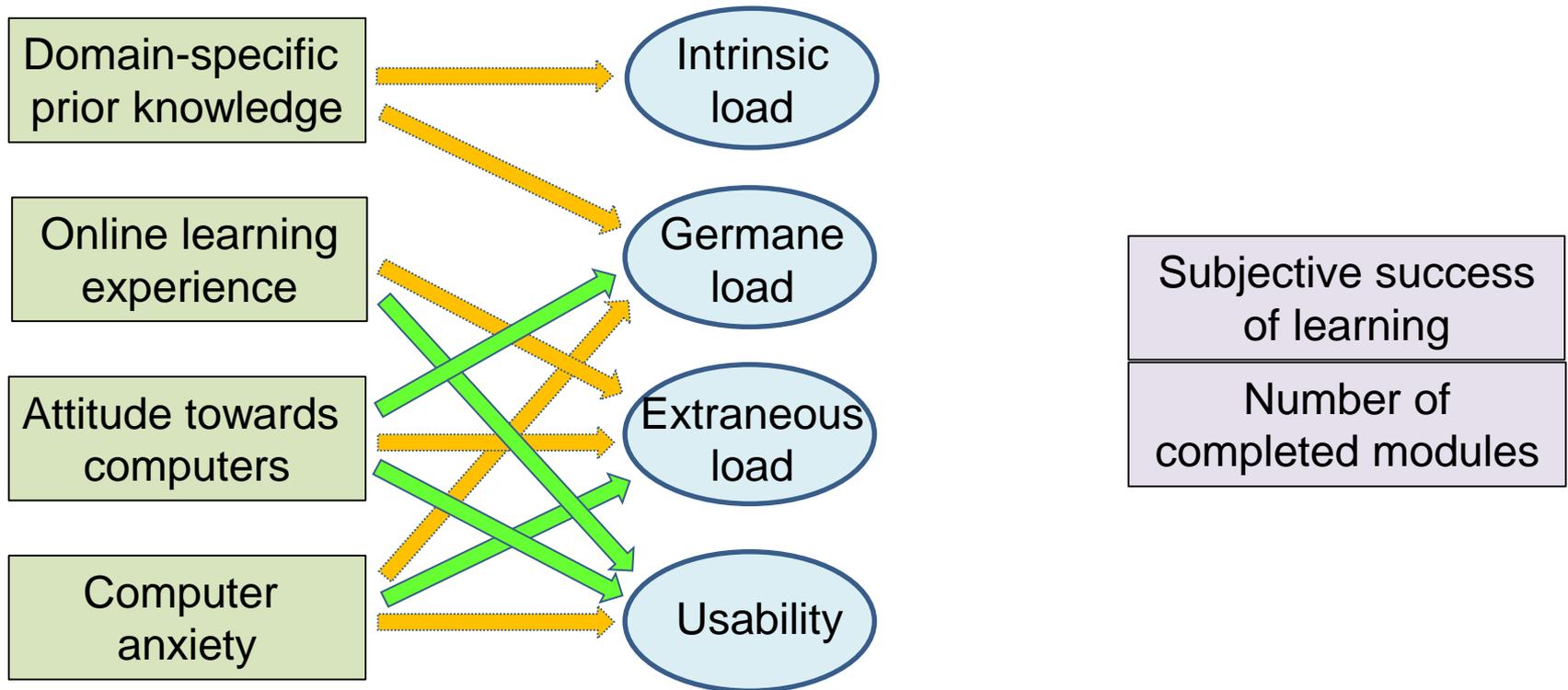
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Domain-specific prior knowledge

Online learning experience

Attitude towards computers

Computer anxiety

Intrinsic load

Germane load

Extraneous load

Usability

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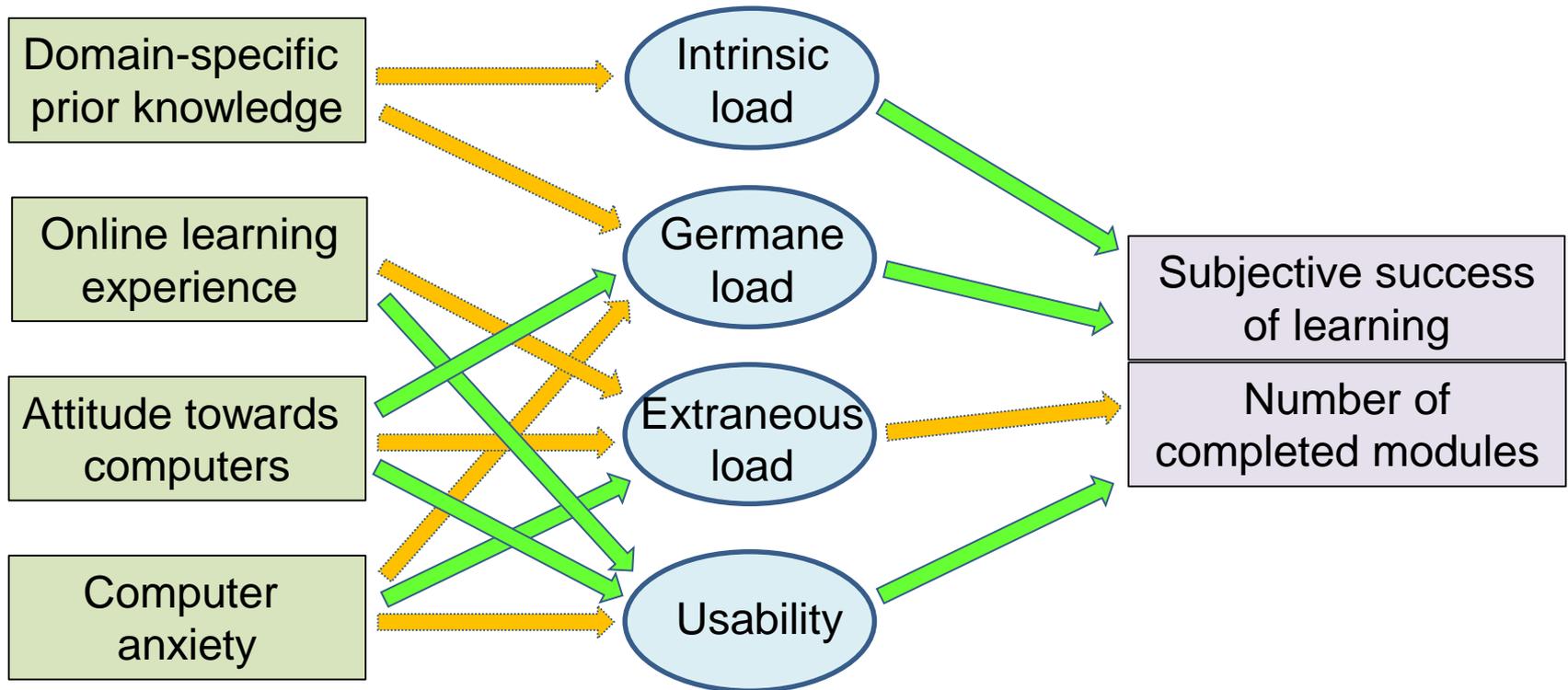
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Domain-specific prior knowledge

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Method - Participants

58 employees participated seriously (worked on at least one module task)
- 28 provided full sets of data
- mean age 38 years ($SD = 12$)
- 23 female (82.1%) and 5 male (17.9%)
- post-secondary school diploma ($n = 16$, 57.1%) and secondary school or commercial college certificate ($n = 9$, 32.1%)

Size of the enterprises
- one-(wo)man enterprises (21.4%)
- two and nine employees (39.3%, $n = 11$).
- Having more than 250 employees (10.7%, $n = 3$).

The most reported branches
- freelance, economic or technical services
- information and communication,
- health and social systems

Method - NiceDesign4SME

1. self-learning environment
2. purely online -> greatest possible freedom in regards to the time and place of learning
3. modular design in respect to contents
4. instructional videos (problem-based)
5. based on individual tutorial supervision
6. asynchronous tools for communication (such as internal message board)

Method - Measurements

1 week before   <mark>start</mark>   5 weeks after   <mark>12 weeks after (end)</mark>

1ˢᵗ Questionnaire
OL-Experience
Computer attitude
Computer anxiety

Richter et al. (2010)

2ⁿᵈ Questionnaire
Usability

Prümper & Anft (2009)

3ʳᵈ Questionnaire
Subjective success
of learning

13 Video Questionnaires
Prior knowledge
Intrinsic load
Extraneous load
Germane load (elaboration)

Other
Completed modules

Method - Measurements

How much experience do you have with online training?

Have you ever used instructional videos for learning (e.g., from YouTube or CD)?

12 weeks after (end)

1st Questionnaire
OL-Experience
Computer attitude
Computer anxiety

Richter et al. (2010)

3rd Questionnaire
Subjective success of learning

When I use the computer for work, I constantly worry that it might break down.

Anft (2009)

Usability

Working with the computer makes me uneasy.

Questionnaires
Knowledge
load
Extraneous load
Germane load (elaboration)

Other
Completed modules

Method - Measurements

1 week before   start   5 weeks after   12 weeks after (end)

1st Questionnaire
OL-Experience
Computer attitude
Computer anxiety

Richter et al. (2010)

2nd Questionnaire
Usability

Prümper & Anft (2

3rd Questionnaire
uccess

It is complicated to operate the learning environment.

13 Video Questionnaires
Prior knowledge
Intrinsic load
Extraneous load
Germane load (elaboration)

Other
Completed modules

Method - Measurements

1 week before   <mark>start</mark>   5 weeks after   <mark>12 weeks after (end)</mark>

1st Questionnaire
OL-Experience
Computer attitude
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Richter et al. (2010)

2nd Questionnaire
Usability

& Anft (2009)

3rd Questionnaire
Subjective success
of learning

13 Video Questionnaire
Prior knowledge
Intrinsic load
Extraneous load
Germane load (elaboration)

Other
Completed modules

I tried to imagine how I could set the learned into practice.

My level of knowledge about that domain was … (very bad – very good)

How easy or difficult would you consider the content?

How pleasant or bothersome would you consider the presentation format?

Method - Measurements

1 week before   <mark>start</mark>   5 w   <mark>12 weeks after (end)</mark>

1st Questionnaire
OL-Experience
Computer attitude
Computer anxiety

Richter et al. (2010)

Us...

Prümper & Anft (2009)

> I have expanded my knowledge by working through the modules.

3rd Questionnaire
Subjective success of learning

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Other
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Results - Correlations

Table 1
Correlations between the variables used for prediction and the predicted variables

		2	3	4	5	6	7	8	9	10
1	Online learning experience	-.09	-.14	.45*	.10	-.14	-.07	-.11	-.06	.26+
2	Computer attitude	-	-.57**	-.15	-.08	-.03	-.12	.03	.22	.27+
3	Computer anxiety		-	-.03	.10	-.12	-.11	-.01	-.21	-.31+
4	Prior knowledge			-	.03	-.15	.02	-.14	-.19	.21
5	Usability				-	-.22	-.55**	.00	.56**	.32*
6	Intrinsic load					-	.27+	-.03	-.10	.35*
7	Extraneous load						-	-.37*	-.42*	.08
8	Germane load							-	.38*	-.17
9	Subjective success of learning								-	.29
10	Number of completed modules									-

Note. + $p < .10$, one-tailed. * $p < .05$, one-tailed. ** $p < .01$, one-tailed. *** $p < .001$, one-tailed.

Results – Multiple regression (backward)

Table 2
Summary of models

	R	R²	Adjusted R²	F	df₁	df₂	p
Subjective success of learning	.68	.46	.41	10.52	2	25	.001
Number of completed modules	.54	.29	.24	5.17	3	24	.01

Table 3
Results of the multiple linear regression analyses

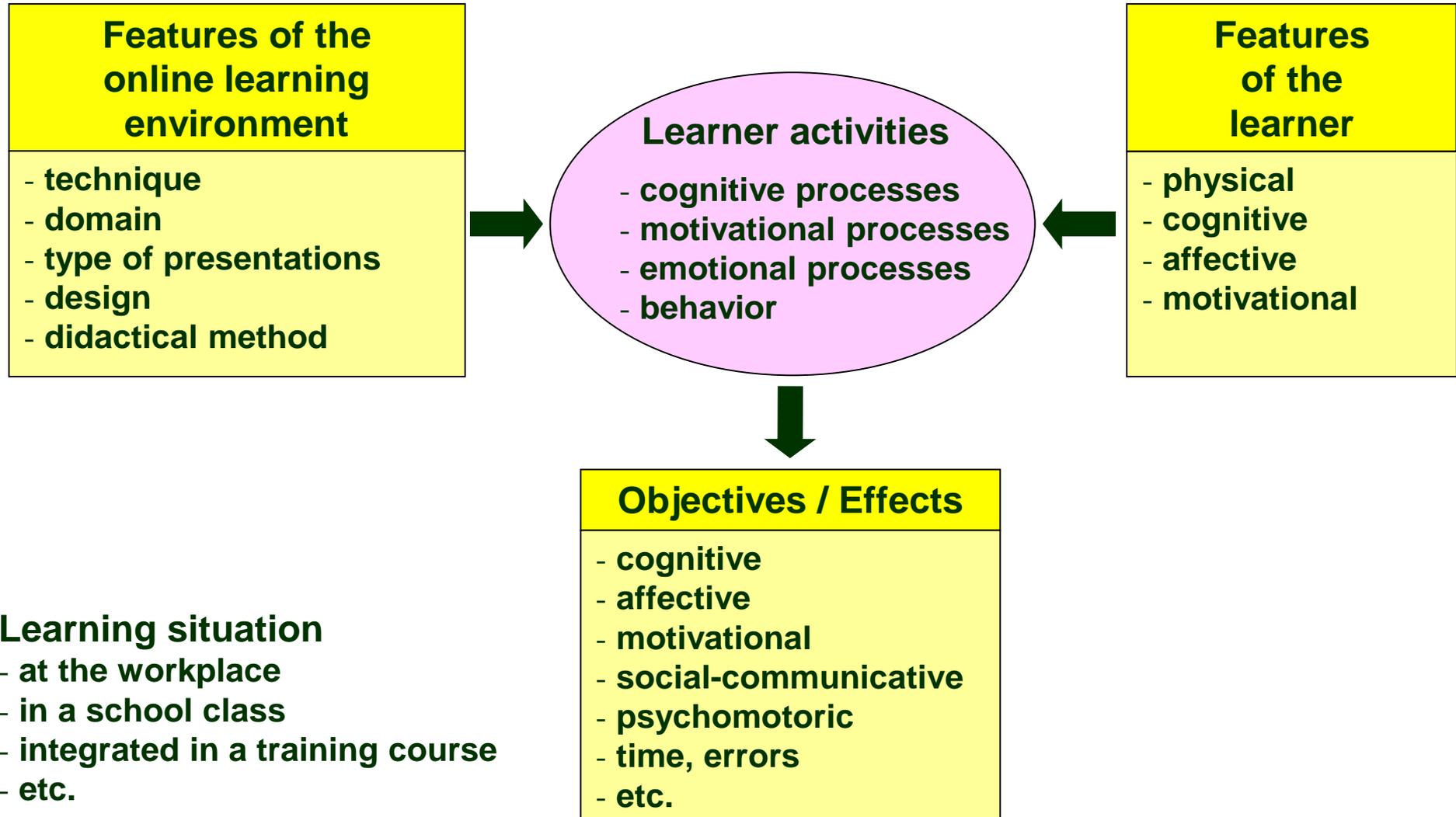|		B	SE	ß	t	df	p
Subjective success of learning	Usability	.43	.11	.56	3.81	25	.01
	Intrinsic load	-	-	-	-	-	-
	Extraneous load	-	-	-	-	-	-
	Germane load	.67	.27	.38	2.54	25	.02
Number of completed modules	Usability	1.68	.69	.42	2.45	25	.02
	Intrinsic load	1.97	.69	.45	2.58	25	.02
	Extraneous load	-	-	-	-	-	-
	Germane load	-	-	-	-	-	-

Discussion

- No modelling by learner characteristics
    - Learners dropping out
- Loads model success of learning

- small sample size
- non-experimental study
- motivation was not considered

- Overall, approaching authentic online learning scenarios under a cognitive load perspective in a broader way was shown to be fruitful.

Any questions?

Introduction

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Features of the online learning environment
- technique
- domain
- type of presentations
- design
- didactical method

Learner activities
- cognitive processes
- motivational processes
- emotional processes
- behavior

Features of the learner
- physical
- cognitive
- affective
- motivational

Objectives / Effects
- cognitive
- affective
- motivational
- social-communicative
- psychomotoric
- time, errors
- etc.

Learning situation
- at the workplace
- in a school class
- integrated in a training course
- etc.

Method - NiceDesign4SME

Graphic and colors	Print media	Digital presentations	General basics
image design	typographical basics	presentation according to Zen	how to write the correct way
image processing	business letter according to DIN 5008	social media	open source
logo design	designing flyers and posters	content strategy	legal basics
		content management systems	