Predicting and resolving non-completion in higher (online) education: A literature review

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Predicting and resolving non-completion in higher (online) education – A literature review

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ABSTRACT

Non-completion in higher education is a persistent problem and even worse of a problem in higher *online* education. Although there is a lot of research on predictors of non-completion, less is known about what interventions resolve the non-completion problem and to what extent these interventions focus on relevant predictors of non-completion. To close that gap, the literature was systematically reviewed with a twofold aim: 1. Identify modifiable predictors of non-completion in higher (online) education 2. Investigate characteristics of effective interventions to reduce non-completion in higher (online) education. Results showed that study- or learning strategies, academic self-efficacy, (academic) goals and intentions, institutional or college adjustment, employment, supportive network, and faculty-student interaction are modifiable consistent predictors of non-completion. Coaching, remedial teaching, and peer mentoring are promising interventions to resolve the problem of non-completion in higher education. Interventions aimed at increasing completion rates are limited in targeting relevant modifiable predictors of non-completion.

1. Introduction

Non-completion is a problem for students, educational institutions and society at large for various reasons that go beyond the straightforward issues of efficiency and effectiveness, such as effects on students' confidence and institutional reputation (Simpson, 2006, 2010; Vossensteyn et al., 2015).

"Completion" in the current research is defined as: meeting the requirements for certification related to a course or program. Completion rates thus indicate the proportion of students enrolling in a course or program and meeting the requirements for certification, within a specified period of time. For this literature review we look at completion rates within the first year of higher education, as most students who do not complete a course or program tend to dropout during or immediately after the first year (Simpson, 2010; Tinto, 2012; Willcoxson, Cotter, & Joy, 2011). Despite the fact that the non-completion problem is on the agenda of numerous universities and the considerable effort from institutions to prevent non-completion, the non-completion numbers are still eminent (Vossensteyn et al., 2015). In the context of traditional higher education, non-completion rates range from 17% to 47% (i.e., based on figures of 14 European countries, see Vossensteyn et al., 2015). Non-completion in the higher *online* educational context (e.g., blended and higher distance education) appear to range from 78% to around 99% (Simpson, 2013). However, non-completion figures are quite diverse, as they are highly dependent on enrolment policy and definitions of completion, and different methods are used to calculate these numbers (Rovai, 2003; Simpson, 2010, 2013; Vossensteyn et al., 2015). On the whole, non-completion is

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worse of a problem in the higher *online* educational context (e.g., blended and higher distance education). First, because the numbers of non-completion are greater, but also because online education has grown tremendously over the past decade (Seaman, Allen, & Seaman, 2018). The higher *online* educational context differs from the traditional higher educational context in various respects. Higher *online* education is delivered fully online or in blended formats (i.e., a combination of online and face-to-face). This generally means more flexibility in the sense that studying becomes largely place, time, and pace independent (Wedemeyer, 2010). As a result, the higher *online* educational context generally attracts students who combine a study with other activities (e.g., a job, family or community obligations). This means that higher *online* education generally, though not exclusively, involves adult learners. It is important to take into account that the ambitions of students in higher *online* education may not be degree-oriented. In this respect, it is important to distinguish between the concepts of completion and study success. Though there is little evidence on this issue, there is research suggesting that not all students in higher *online* education start a course or program with the intention to obtain a certificate (Henderikx, Kreijns, & Kalz, 2017; Schlusmans & Winkels, 2017). Schlusmans and Winkels (2017) for instance, have reported that in a distance university context, approximately one-third of the students do not aim to obtain a diploma. It might be that these students, enrolling in a course or program without completion still have attained particular learning goals. Therefore, they cannot be said to have failed or been unsuccessful. For this reason, we here use the more neutral terms completion and non-completion in higher (online) education, rather than a term like 'study success'. However, even taking this into account, completion rates in higher online education demand improvement (Rovai, 2003; Schlusmans & Winkels, 2017). Though to a certain extent, non-completion is inherent in higher (online) education, current figures are still seen as problematic, as evidenced by the many studies and initiatives in higher (online) education to explain and/or reduce non-completion. One of the reasons that non-completion rates are still poor might be that initiatives taken to reduce non-completion do not focus on relevant variables explaining or predicting non-completion and this will be the focus of the current review. There are two determinants in the completion rate equation: the number of students meeting the requirements (numerator) and the number of students enrolling (denominator). In theory, then the odds of completing (completion rates) will improve when either more students meet the requirements under equal enrolment numbers, or the number of students meeting the requirements remains the same under reduced numbers of enrolment. The latter effect might stem, for instance from, a communication and admission policy that increases the chances that those enrolling will meet the requirements. Increasing the number of students meeting the requirements might be achieved by increasing the effectiveness of the learning process, for instance, by more adequate instruction, tutoring, and guidance. In other words, interventions to increase completion rates are possible both prior to and after enrolment. Interventions prior to enrolment might be, for instance, a trial studying procedure for prospective students, or diagnostic assessments. After enrolment, there is a wide variety of possible interventions, for example, a counseling trajectory with a student advisor, training in effective learning strategies or curriculum changes to enhance completion rates. In line with this completion rate equation, Elffers (2018) refers to a trilemma involving accessibility of education, quality of education, and study success. According to this trilemma, study success can be increased by reducing the accessibility of education on one hand or increasing the quality of education on the other hand. It goes without saying that accessibility constitutes a sensitive ethical issue, which especially in the context of open education, is subject to certain constraints.

Before effective and efficient interventions can be designed and researched, it is important to have a comprehensive picture of the modifiable factors that predict non-completion, so that interventions can be developed targeting those factors that are likely to sort most effect. To inform the future development of interventions aimed at further improvement of completion rates, a literature review was conducted. The following two research questions guide this endeavour¹:

1. Which (modifiable) variables are most strongly related to non-completion in higher (online) education? As several review studies have already tried to summarize the vast amount of studies aiming to explain the non-completion problem, this literature review addressing this question will build on these review studies.
2. What are the key characteristics of interventions that proved effective in increasing completion rates, in which context and to what extent? To our knowledge, no systematic review of intervention studies has been done yet. It will be interesting to relate the answers to both questions, to see to what extent interventions developed so far, actually target the variables which the review studies indicate to be most strongly related to non-completion.

In the next section a detailed description of the literature search, selection and data synthesis will be provided.

2. Methods

2.1. Search and selection

To find relevant articles in line with the aim of this review we consulted all EBSCOhost databases. EBSCOhost entails Academic Search Elite, Business Source Premier, GreenFILE, Library, Information Science & Technology Abstracts (LISTA), PsycArticles, Psychology and Behavioral Sciences Collection, PsycINFO, and Regional Business News databases.

¹ In the next sections we will refer to higher education as the context of this research, by which we thus mean traditional higher education, but also higher *online* education.

Table 1

Search terms.

Search terms for review articles on predicting non-completion in higher education
1. Context: "university" OR "college" OR "higher education" OR "distance education" OR "online education" OR "online course" OR "adult education" AND 2. Target group: "learner" OR "student" OR "undergraduate" AND 3. Outcome measure: "stud* success" OR "stud* performance" OR "complet*" OR "drop* out" OR "persist*" OR "attrition" OR "achiev*" OR "progress*"
Search terms for intervention studies to raise completion rates in higher education
1. Context: "higher education" OR "university" OR "distance" AND 2. Outcome measure: "dropout" OR "non-completion" AND 3. Intervention studies: "intervention" OR "prevention" OR "program" Complemented by additional search terms in a second literature search: 4. "matching" OR "selection" OR "study choice" OR "study decision"

2.1.1. Predictors

The search terms for the predictors of non-completion in higher education are presented in Table 1. This search was executed between March and April 2018. To find review studies on predictors of non-completion we defined search terms concerning context, target group and outcome measure and applied them for "all text." Several inclusion criteria were identified concerning review articles on predicting non-completion. These are presented in Table 2. The initial database search resulted in 929 articles. Duplicates were removed manually, resulting in 902 unique articles. These articles were screened based on the inclusion criteria by title and abstract, and if necessary and available, whole text. If the whole text was required but not available, it was requested by contacting the authors. After full-text reading, eight review articles were included. A considerable number of articles was excluded in this step, because the outcome measure of completion was related to a medical field, such as treatment completion for drug abuse. Two articles were already at our disposal before database search, and met the inclusion criteria. These additional articles were included, resulting in a total of ten articles. This selection process is presented in Fig. 1.

2.1.2. Interventions

The search terms for intervention studies designed to raise completion rates in higher education are presented in Table 1. To find relevant intervention studies the same search terms as mentioned above supplemented with "interven*" or "prevent*" or "program" were applied. The most relevant hits were found using the search terms presented in Table 1. The database search for this part of the literature review was executed between May and June 2018 and later extended with a complementary search when it appeared that the results based on the initial search terms did not yield any interventions prior to student enrolment. For the intervention studies, we also defined some selection criteria, as presented in Table 2. Results of the database search were refined using relevant major heading and subject tags in EBSCOhost. The initial search and complementary search together resulted in 162 unique articles (134 from the initial search, 28 from the complementary search). These articles were screened based on the inclusion criteria, first on title and abstract. Again, if the title and abstract did not provide sufficient information the full text of the article was screened. After screening on title and abstract, there were 21 articles left (16 from the initial search, 5 from the complementary search). The screening of full text articles resulted in eight remaining articles (6 from the initial search, 2 from the complementary search). All

Table 2

Inclusion criteria.

Inclusion criteria for review studies on predictors of non-completion in higher education
1. The article is peer-reviewed and published in an academic journal 2. This article is a review or meta-analysis 3. The outcome variable is non-completion or related (persistence, retention, attrition, dropout) 4. The article is written in English, Dutch or Flemish 5. The target group is in higher (online) education 6. The target group is not a highly specific target group (e.g., minorities, students with a disability) 7. The independent variables are within the scope of our review
Inclusion criteria for intervention studies to raise completion rates in higher education
1. The article is peer-reviewed and published in an academic journal 2. The outcome variable is non-completion or related (persistence, retention, attrition, dropout) 3. The article is written in English, Dutch or Flemish 4. The study entails an investigation of an intervention with the purpose to increase completion rates in higher (online) education 5. The target group is in higher (online) education 6. The target group is not a highly specific target group (e.g., minorities, students with a disability) 7. The intervention is within the scope of our review (e.g., interventions originate from the institution itself and not from for instance, governance funding of students etc.) 8. The article is published in or after 2000

Fig. 1. Flowchart of the paper selection process for review studies on factors predicting non-completion in higher education.

articles selected for whole text screening were discussed with all members of the research team, until consensus was reached. By applying the snowballing technique (i.e., checking the references of the included articles to find more relevant articles), eight additional articles were included (5 initial, 3 complementary search). Thus, after the first literature search for intervention studies we included sixteen articles. The selection process is presented in Fig. 2.

2.2. Data generation and synthesis

2.2.1. Predictors

To obtain the results of the review studies on factors predicting non-completion, a data abstraction form was created, of which the components are presented in Table 3. In addition, the following data was extracted into a second form to evaluate the quality of the review studies: whether the databases and search terms as well as inclusion and exclusion criteria were given, the number of studies included, whether definitions and operationalization of (in)dependent variables were provided and whether the authors discussed the generalizability of both their review results and the individual studies they included. Two researchers independently summarized the articles according to these two forms, after which they discussed differences with each other and the other members of the research team until agreement was met. The results to evaluate the quality of the review studies is presented in Table 6 in the supplementary materials.

As a vehicle to present our findings on predictors of non-completion consistently and concisely we have chosen the generic model by Cross (1981). This model differentiates between three categories of variables related to student participation in higher education. First, *dispositional factors* are defined as individual factors, internal to the student, which may inhibit students' participation in higher education. Carroll, Ng, and Birch (2009) refer to beliefs, values, attitudes and perceptions in defining dispositional factors. Second, *situational factors* are defined as factors related to the circumstances in students' particular lives, for instance, employment and family commitments. Third, *institutional factors* are defined as "factors outside of the student's control, but those factors resulting from procedures, policies and structures of the educational institution that are related to students' participation in higher (online) education" (Carroll et al., 2009, p. 199). The simple distinction between these three categories, makes the model very suitable as an initial framework to organise the wide variety of results from different studies. Considering our purposes, however, it became clear early in the process of reviewing that the model would benefit from a small extension, namely a subdivision of the category of dispositional factors into dispositional cognitive factors (i.e., ability or relevant knowledge, skills and experiences) and dispositional non-cognitive factors (i.e., affective and attitudinal factors). In addition, a category of demographic factors was added to the model. Fig. 3 presents the full classification framework used. Two researchers independently categorized the results and uncertainties or differences between the categorization of the two researchers were discussed with the other members of the research team until consensus was reached.

2.2.2. Interventions

For the review on intervention studies, the same data extraction procedure was followed for partly different data, as presented in

Fig. 2. Flowchart of the paper selection process on intervention studies.

Table 3

Data extraction components.

Data extraction components for review articles on predicting non-completion in higher education
<ol style="list-style-type: none"> 1. Reference 2. Educational context 3. Outcome measure (definition and operationalization) 4. Independent measure(s) (definition and operationalization) 5. Results 6. Conclusion
Data extraction components for intervention studies to raise completion rates in higher education
<ol style="list-style-type: none"> 1. Reference 2. Research question 3. Purpose of the study 4. Sample (size) 5. Factors manipulated or targeted at by the intervention (e.g., academic self-efficacy or motivation) 6. Description of the intervention 7. Duration of the intervention 8. Theoretical underpinning of the intervention instrument and the target factor 9. Outcome measure related to non-completion 10. Results 11. Conclusion

Fig. 3. Classification framework (adapted from Carroll et al., 2009).

Table 3. To answer the second research question and identify the characteristics of effective interventions for raising completion rates we focused on the following characteristics:

- Intervention approach or strategy (e.g., mentoring, remedial teaching).
- Targeted factors (from the categories from the classification framework, see Fig. 3).
- Mode (online intervention, face-to-face intervention or a combination).
- Context (traditional higher education, online higher education or both).
- Duration of the intervention.
- Effect (whether the intervention raised completion rates significantly, effect size(s), and differences in completion rates between groups or cohorts)
- Cost effectiveness.

Interventions were categorized based on similarity of the treatment as coaching or remedial teaching, peer mentoring, motivational contact, academic dismissal policies or interventions on instruction, to present the results in an organized manner. With regard to the quality of the intervention studies we classified the sample size, whether the sampling method was discussed, whether the intervention method and decision for a target factor were theoretically underpinned and whether authors discussed generalizability of their results, and possible threat to internal validity. The results with regard to the quality of the intervention studies are presented in Table 7 in the supplementary materials.

Table 4

Overview of the included articles and the corresponding categories from the theoretical framework on predictors of non-completion in higher education.

^a	Reference	Categories
1.	Pascarella (1980)	Institutional
2.	Robbins et al. (2004)	Demographic, dispositional cognitive, dispositional non-cognitive, institutional
3.	Riggert, Boyle, Petrosko, Ash, & Rude-Parkins (2006)	Situational
4.	Trapmann et al. (2007)	Dispositional non-cognitive
5.	Lee and Choi (2011)	Dispositional cognitive, dispositional non-cognitive, situational, institutional
6.	O'Neill et al. (2011)	Demographic, dispositional cognitive, dispositional non-cognitive, institutional
7.	Credé and Niehorster (2012)	Dispositional non-cognitive
8.	Bowles and Brindle (2017)	Demographic, dispositional cognitive, dispositional non-cognitive, situational, institutional
9.	Fong, Davis, Kim, Kim, Marriott, & Kim (2017)	Dispositional non-cognitive
10.	Van Rooij et al. (2018)	Demographic, dispositional cognitive, dispositional non-cognitive

^a These numbers are also used to refer to the articles in Table 8 in the supplementary materials.

3. Results

3.1. Predictors of non-completion

3.1.1. Quality appraisal

Before describing the results, we discuss the quality of the review studies included in the first part of the review. We also scored the included articles on the quality criteria discussed in section 3.1, for which we refer to Table 6 in the supplementary materials. We have found 10 review studies (see Table 4), of which only two were meta-analyses that applied certain quality criteria (e.g., effect sizes), as a threshold for including studies in their review (Fong, Davis, Kim, Kim, Marriott, & Kim, 2017; Robbins et al., 2004). The other studies provide a more narrative overview, or provide a systematic overview without reporting quantitative results (Bowles & Brindle, 2017; Credé & Niehorster, 2012; Lee & Choi, 2011; O'Neill, Wallstedt, Eika, & Hartvigsen, 2011; Pascarella, 1980; Riggert, Boyle, Petrosko, Ash, & Rude-Parkins, 2006; Trapmann, Hell, Hirn, & Schuler, 2007; Van Rooij et al., 2018). The number of studies/articles taken into account for individual factors in the review studies ranged from 6 (for six factors in Robbins et al., 2004) to 36 (for one factor in Robbins et al., 2004). Nine out of ten review studies discussed which databases were used to find relevant articles, and six of them defined and reported search terms. Nine review studies presented in- or exclusion criteria used in screening articles. Important to take into account when interpreting the results presented in the next paragraph, is that there were considerable differences in operationalization and definition of the same variables included in different review studies (e.g., motivation as defined and measured by Robbins et al., 2004 and Fong, Davis, Kim, Marriott, & Kim, 2017). In some review studies, specific definitions and operationalization used in the individual studies they have included were not discussed. In terms of generalizability, some review studies focused on predictors of non-completion in a specific country (Van Rooij et al., 2018) or a specific study program (e.g., O'Neill et al., 2011). Eight out of ten review studies discussed generalizability of their findings. With respect to generalizability it is important to note that two review studies (although they discussed generalizability of their results) reported significant results only, leaving it unclear to what extent the individual studies included in their review also investigated the predictive value of other variables without significant results. The results of these two review studies may be generalizable, but they leave out important information and in doing so have a limited contribution to obtaining a comprehensive picture. Based on our assessment of the quality of the review studies, we decided to exclude some predictors discussed in these studies from further analyses, because their definition and operationalization appeared not sufficiently distinct from the independent (outcome) variables (e.g. persistence, dropout). For instance, we excluded academic struggling, operationalized as the amount of failed science tests in the first year of higher education, grade point average in the first year of higher education and decelerated curriculum status (O'Neill et al., 2011), academic momentum and academic success (Bowles & Brindle, 2017), and current grade point average (Lee & Choi, 2011). This was, to us, not enough reason to exclude these review studies fully from analyses, though this explains why not all variables from all review studies will be discussed in the results section. Next, the results of the review studies on predictors of non-completion in higher education will be described, organized in the categories as explained in section 2.2. These results are presented in Table 8 in the supplementary materials and an overall synthesis of the results is presented in Fig. 4.

3.1.2. Results on predictors of non-completion in the classification categories

3.1.2.1. Demographic variables. Four review studies (of which one meta-analysis) focused on demographic factors in relation to non-completion. All four studies focused on socioeconomic status, for which inconsistent results were found in relation to non-completion outcomes (Bowles & Brindle, 2017; O'Neill et al., 2011; Robbins et al., 2004; Van Rooij et al., 2018). Age, gender, and parents' education were all investigated in two review studies, and for all three factors, inconsistent results were found in individual studies (see O'Neill et al., 2011 for age, gender and parents' education; Bowles & Brindle, 2017 for age and parents' education; Van Rooij et al., 2018 for gender). Consistent results were found for the link between ethnicity and student dropout, though only investigated in one of the included review studies (O'Neill et al., 2011). All four studies included in that review by O'Neill et al. (2011) indicated no significant relation between ethnicity and dropout.

3.1.2.2. Dispositional cognitive variables. Six review studies (of which two meta-analyses) included dispositional cognitive variables. One of the most consistent results is found for entry qualifications, like high school grade point average, and scores on pre-entry tests (i.e., in American higher education context, ACT or SAT scores). These factors showed to be significantly positively related to persistence outcomes (Lee & Choi, 2011; O'Neill et al., 2011; Robbins et al., 2004; Van Rooij et al., 2018). Five out of six review studies included learning or study strategy factors. Out of these five, four report a significant relation with non-completion (significant in Robbins et al., 2004; Lee & Choi, 2011; Bowles & Brindle, 2017; Van Rooij et al., 2018; not significant in Fong et al., 2017). The meta-analysis by Robbins et al. (2004) reports an estimated true correlation between academic-related skills and retention of 0.366. Important to note with respect to learning or study strategy factors is the difference in definition and operationalization within and between different review studies. Two out of six review studies focused on preparedness (Bowles & Brindle, 2017; Van Rooij et al., 2018), which was not a factor of interest in the other four review studies. Inconsistent results between and within review studies were reported with respect to the link between this factor and non-completion outcomes.

Factors investigated only in singular review studies were: number of online courses completed previously, experience in relevant field, involvement in professional activities, computer skills (Lee & Choi, 2011), and intelligence (Van Rooij et al., 2018). The factors investigated by Lee and Choi (2011) were all found to be negatively related to online course dropout. Intelligence was not found to be significantly related to persistence by Van Rooij et al. (2018), however, this was based on only one scientific study.

3.1.2.3. Dispositional non-cognitive variables. A large number of studies focused on dispositional non-cognitive factors. In total, eight review studies (of which two meta-analyses) focused on variables within this category (Bowles & Brindle, 2017; Credé & Niehorster, 2012; Fong et al., 2017; Lee & Choi, 2011; O'Neill et al., 2011; Robbins et al., 2004; Trapmann et al., 2007; Van Rooij et al., 2018). Five review studies included motivational factors, and investigated the relationship with non-completion outcomes (Bowles & Brindle, 2017; Fong et al., 2017; Lee & Choi, 2011; Robbins et al., 2004; Van Rooij et al., 2018). Four of them found positive significant relationships for motivational factors and persistence or retention outcomes (Bowles & Brindle, 2017; Fong et al., 2017; Lee & Choi, 2011; Van Rooij et al., 2018). Fong et al. (2017) reported a significant correlation of 0.150 in their meta-analysis. However, Robbins et al. (2004) reported a non-significant estimated true correlation of only 0.066. In addition, intrinsic motivation, as investigated by Van Rooij et al. (2018) was not found to be significantly related to retention in the majority of the studies they reviewed (non-significant in four studies, positively significant in two studies). Extrinsic motivation in their review study was consistently not related to persistence. In two out of the three studies they have included 'study motivation', which was positively related to persistence. Lack of motivation was negatively related to persistence in two out of two studies included by Van Rooij et al. (2018). Differences in definition and operationalization of motivational factors within and between review studies complicate an accurate evaluation of these contradictory results.

Four review studies investigated self-efficacy (Robbins et al., 2004; Bowles & Brindle, 2017; Fong et al., 2017; Van Rooij et al., 2018), and reported consistent positive relationships between self-efficacy and persistence or retention outcomes. Robbins et al. (2004) found an estimated true correlation between self-efficacy and retention of 0.359, while Fong et al. (2017) reported a correlation between self-perceptions (including self-efficacy) and persistence of 0.100. Robbins et al. (2004) found no significant relationship between general self-concept and retention. Factors investigated in three review studies and resulting in consistent results were: goals and intentions (Robbins et al., 2004; Bowles & Brindle, 2017; Lee & Choi, 2011), institutional or college adjustment (Robbins et al., 2004; Credé & Niehorster, 2012; Van Rooij et al., 2018), and personality characteristics (Trapmann et al., 2007; Bowles & Brindle, 2017; Van Rooij et al., 2018). Goals and intentions were significantly positively related to retention or persistence outcomes (Robbins et al., 2004; Bowles & Brindle, 2017; Lee & Choi, 2011). Robbins and colleagues reported an estimated true correlation of 0.340 between academic goals and retention. Three review studies investigated the predictive value of institutional or college adjustment factors. These factors refer to the extent to which a student has adapted to academic demands, which is defined by a student's attitude toward the study program or course, their engagement with the study material and the adequacy of their efforts in studying (Credé & Niehorster, 2012). These factors are thus clustered in the category of dispositional non-cognitive factors (and not to institutional factors), because they refer to processes inherent to the student, and not the institute. Institutional or college adjustment factors were significantly positively related to retention or persistence outcomes in all three studies investigating this link (Robbins et al., 2004; Credé & Niehorster, 2012; Van Rooij et al., 2018). Robbins et al. (2004) reported an estimated true correlation of 0.206 for this link, Credé and Niehorster (2012) reported an estimated true correlation of 0.230 for this relationship. Moreover, Credé and Niehorster (2012) reported effect sizes of subscales of institutional adjustment, in which the largest estimated true correlation was found between institutional attachment and retention of 0.290, followed by the predictive value of social adjustment (true score correlation = 0.250), academic adjustment (true score correlation = 0.190) and personal-emotional adjustment (true score correlation = 0.130). Inconclusive results between review studies were found with respect to the relation between personality characteristics and non-completion outcomes (Trapmann et al., 2007; Bowles & Brindle, 2017; Van Rooij et al., 2018). Attributions were examined as a predictor of non-completion in two of the review studies, for which different results were found (significantly related to non-completion in Lee & Choi, 2011; no significant results in Fong et al., 2017). For results other dispositional non-cognitive factors we refer to Table 8, as they were investigated in only one of the included review studies, for instance anxiety, which was not significantly related to completion outcomes (Fong et al., 2017) and difficulty juggling commitments, which was negatively related to completion outcomes, (Bowles & Brindle, 2017).

3.1.2.4. Situational variables. Three of the included review studies investigated the relationship between situational variables and non-completion outcomes. The relationship between employment factors and non-completion outcomes was investigated in all of these three review studies (Bowles & Brindle, 2017; Lee & Choi, 2011; Riggert, Boyle, & Petrosko, 2006). While Lee and Choi (2011)

and Bowles and Brindle (2017) reported a straightforward positive relationship between employment pressures or commitments and student dropout, Riggert et al. (2006) reported a more complex relationship between employment and completion outcomes. This latter review indicates that 1–15 employment hours) might be beneficial for completion rates as compared to no employment commitment at all. Financial aid or scholarship (Bowles & Brindle, 2017; Lee & Choi, 2011), and supportive social networks (Bowles & Brindle, 2017; Lee & Choi, 2011) were investigated in two out of three review studies. Financial aid or attainment of a scholarship are consistently positively related to completion outcomes, as are supportive social networks or emotional support (Bowles & Brindle, 2017; Lee & Choi, 2011). Other factors were investigated in only one review study (see Table 8). For instance, family responsibilities or pressures (e.g. from controlling parents) relate negatively to completion outcomes (Bowles & Brindle, 2017).

3.1.2.5. Institutional variables. Five review studies (of which one meta-analysis) investigated the relationship between institutional variables and non-completion outcomes (Bowles & Brindle, 2017; Lee & Choi, 2011; O'Neill et al., 2011; Pascarella, 1980; Robbins et al., 2004). Three of these investigated the relationship or interaction between faculty (staff) and students, reporting significant positive relations with persistence. In only one out of seven individual studies included by Pascarella (1980) no significant relationship was found. Financial support by the institute, size of the institute, and selectivity of the institute, were investigated by two review studies (Bowles & Brindle, 2017; Robbins et al., 2004). Both studies report a significant positive relationship for financial support (estimated true correlation of 0.188 in Robbins et al., 2004). For size of the institute, an estimated true correlation of -0.010 was reported by Robbins et al. (2004), which was not significant. A significantly negative relationship was found between size of the institute and retention rates by Bowles and Brindle (2017). For institution selectivity (i.e., the extent to which educational institutions set a standard for selecting new students) a significant positive link with retention outcomes was reported by Robbins et al. (2004) (estimated true correlation = 0.238) and Bowles & Brindle (2017). All other factors in this category were investigated in one review study only, for which we refer to Table 8. For instance, curriculum type, which is investigated by O'Neill et al. (2011), reporting higher student dropout in traditional curriculum type, as compared to a problem-based learning curriculum type.

3.1.3. Synthesis of results on predictors of non-completion

One of the aims of this review study was to create an overview of (modifiable) variables that are related to non-completion in higher education. In Fig. 4 we present an overview of the variables related to non-completion, based on the results of this literature review and categorized according to the model presented in Fig. 3. We indicated whether factors are modifiable (i.e., changeable or to be advised on) by putting a lock on those variables that are not modifiable. We did not take into account variables investigated by only one of the included review. In this figure, variables are presented in alphabetical order (per category of the theoretical framework).

All in all, modifiable consistent predictors of non-completion in higher education are study- or learning strategies, academic self-efficacy, (academic) goals and intentions, institutional or college adjustment, employment, supportive network and faculty-student interaction. For these factors there were three review studies providing effect size by means of estimated true correlations. The most effective modifiable consistent predictors for non-completion based on these review studies seem to be study-/learning strategies or skills (estimated true correlation of 0.366, see Robbins et al., 2004), academic goals and intentions (estimated true correlation of 0.340, see Robbins et al., 2004), academic adjustment/adaptation and involvement (estimated true correlations of 0.206–0.230, see Robbins et al., 2004 and Credé & Niehorster, 2012), and academic self-efficacy (estimated true correlation of 0.359, see Robbins et al., 2004). We need to take into account some points in interpreting these results. Some factors that might be modifiable were not investigated in a thorough number of review studies (e.g., computer skills in the category dispositional cognitive factors). There are also consistent predictors of non-completion in higher education that do not seem modifiable, but maybe are. Entry qualifications in the category of dispositional cognitive factors might be such a factor. Some entry qualifications cannot be changed, of course (e.g., grade point average in high school). However, other entry qualifications, mathematical skills for instance, might be subject to interventions in which this factor is tested and remedial teaching is provided if necessary. Employment itself cannot be changed by interventions implemented by educational institutions, however the amount of employment hours also gives an indication about the amount of hours students can spend on their studies, on which students can be advised by educational institutions. Therefore, we did not put a lock on the employment factor. Important to note is that due to a lack of comparability and effect sizes, the results on modifiable predictors of non-completion are still rather inconclusive. Especially in the category of dispositional non-cognitive factors there is a lack of comparability, because overlapping constructs are operationalized differently (e.g., academic study skills and learning strategies) or the same operationalization is used for a slightly different construct (e.g., self-esteem questionnaires used to measure self-concept) and in the majority of the review studies definitions or operationalization of constructs are not provided. Finally, with respect to generalizability of these results, only two of the review studies concerned a higher online educational context, which means that drawing conclusions on predictors of non-completion in this context should be done with caution.

3.2. Intervention studies

In the results section of the intervention studies, the interventions and the corresponding results with respect to completion rates are described first, grouped in different categories of interventions (see Table 5), in chronological order. After that, in section 4.4 an overview will be presented of the characteristics of effective and efficient interventions, in line with our second research question. The characteristics we focus on are based on the data extraction components and were discussed in section 2.2.

Fig. 4. Overview of variables related to non-completion in higher education.

Table 5

Overview of the included articles on interventions to raise completion rates in higher education and the corresponding category of interventions.

^a	Reference	Intervention category
1.	Wang and Grimes (2000)	Coaching/remedial teaching
2.	Chyung (2001)	Intervention on instruction
3.	Pagan and Edwards-Wilson (2002)	Peer mentoring
4.	Ruthig, Perry, Hal, & Hladkyj (2004)	Coaching/remedial teaching
5.	Salinitri (2005)	Peer mentoring
6.	Huett, Kalinowski, Moller, and Huett (2008)	Motivational contact
7.	Simpson (2008)	Motivational contact
8.	Larose, Cyrenne, Carceau, Harvey, Guay, Godin, ..., & Deschênes (2011)	Peer mentoring
9.	Martorell and McFarlin (2011)	Coaching/remedial teaching
10.	Stegers-Jager, Cohen-Schotanus, Splinter, & Themmen (2011) ^b	Academic dismissal policy
11.	Bettinger and Baker (2014)	Coaching/remedial teaching
12.	De Paola and Scoppa (2014)	Coaching/remedial teaching
13.	Patterson, Waya, Ahuna, Tinnesz, and Vanzile-Tamsen (2014)	Coaching/remedial teaching
14.	Arnold (2015) ^b	Academic dismissal policy
15.	Inkelaar and Simpson (2015)	Motivational contact
16.	Sneyers and De Witte (2017) ^b	Academic dismissal policy

^a These numbers are also used to refer to the articles in Table 9 in the supplementary materials.

^b These articles concern the same intervention for overlapping data sets. Article 14 is about Dutch university samples from 2002 to 2007, article 16 is about Dutch higher education samples (including university samples) from 2003 to 2004 and 2008–2009 and article 10 is about a specific single Dutch university sample from 2003 to 2004 and 2005–2006.

3.2.1. Quality appraisal

Before elaborating on the results of the intervention studies, we will as in part one, first discuss the quality of the intervention studies included in this literature review. The included articles are scored on these quality criteria in Table 7 in the supplementary materials. As presented in Table 5, 16 intervention studies have been included in the present literature review. Four of these intervention studies were carried out (at least partly) in the context of higher *online* education (Chyung, 2001; Huett et al., 2008; Inkelaar & Simpson, 2015; Simpson, 2008). The total number of participants in these intervention studies ranged from 12 (Chyung, 2001) to 255878 (Martorell & McFarlin, 2011). Six of the interventions investigated were (at least partly) online interventions (Bettinger & Baker, 2014; Chyung, 2001; Huett et al., 2008; Inkelaar & Simpson, 2015; Ruthig, Perry, Hall, & Hladkyj, 2004; Simpson, 2008). Interventions lasted from a minimum of one informal session (Ruthig et al., 2004) until one year (Arnold, 2015; Bettinger & Baker, 2014; Larose et al., 2011; Salinitri, 2005; Sneyers & De Witte, 2017; Stegers-Jager, Cohen-Schotanus, Splinter, & Themmen, 2011), though not all intervention studies gave details regarding the duration of the intervention. In terms of generalizability there are several points that require attention. Some of the results in these intervention studies are based on rather small sample sizes (Chyung, 2001; Salinitri, 2005; Simpson, 2008), some of the interventions are evaluated for rather specific target groups, although most of the underlying mechanisms in these interventions seem generalizable to other target groups as well. For example, the intervention by De Paola and Scoppa (2014) was investigated in the Italian educational context, which is (in the explanation the authors provided) comparable to the traditional Dutch higher educational context. In contrast, some parts of the intervention by Chyung (2001) are inherent to the educational context in which the intervention is investigated (specifically for students enrolled in the ‘Instructional and Performance Technology’ program), resulting in decreased generalizability of the intervention to other educational contexts. In ten of the included intervention studies generalizability of the results was discussed. In terms of threat to internal validity, also multiple points need to be stressed. For instance, in a majority of the intervention studies there has been no manipulation check, to analyse whether the factor that was aimed to be modified (e.g., motivation), actually changed by the intervention (Bettinger & Baker, 2014; De Paola & Scoppa, 2014; Inkelaar & Simpson, 2015; Pagan & Edwards-Wilson, 2002; Patterson et al., 2014; Ruthig et al., 2004; Salinitri, 2005; Simpson, 2008). In addition, in some intervention studies actually multiple interventions are evaluated at once, which makes it hard to interpret the results on effectiveness of the intervention characteristics (Chyung, 2001; Huett et al., 2008; Wang & Grimes, 2000). In some intervention studies a control group was included, however, in some cases this entailed a passive control group, which means that results on effectiveness of the intervention might also be due to the fact that the experimental group underwent at least some procedure, independent from what the actual procedure entailed (e.g., Inkelaar & Simpson, 2015; Larose et al., 2011). Additionally, in some intervention studies there might have been a self-selection bias (e.g., based on first come, first served principle for remedial teaching or voluntary basis)(e.g., Patterson et al., 2014; Ruthig et al., 2004). In eleven of the intervention studies there was attention for possible threats to internal validity by either addressing them in discussing their findings or even taking measures to prevent threats to internal validity. The results of the intervention studies are presented in Table 9 in the supplementary materials.

3.2.2. Results on intervention studies in the intervention categories

3.2.2.1. Coaching and remedial teaching. In this category of interventions we discuss results of interventions in which students received some sort of coaching/mentoring or remedial teaching by professional teachers, trainers or coaches. Wang and Grimes (2000) evaluated the Access Plus Program in traditional higher education. This program involved multiple offers for freshmen in college, for instance an advising program, a seminar course, interest groups, and remedial teaching for English and mathematics. The

duration of this intervention and number of participants included in the study were not specified. The Access Plus Program aimed at improving academic motivation, social motivation, general coping skills and receptivity to institutional support, which were all measured prior to the start of the intervention by the College Student Inventory. However, no post-measurement was carried out. It was reported that after this intervention there was a 10% increase for freshmen to sophomore (the second) year.

Ruthig et al. (2004) investigated an optimism and attributional retraining program in the context of traditional higher education. This program consisted of an informal session, which was executed differently in three groups. The information of interest in this informal session was presented by either a videotape of 8 min, the videotape followed by a 20-min group discussion or a handout only. Theories underlying the intervention were explained, for instance, unrealistic optimism and attributional theories). In this attributional retraining positive effects of effort attributions (i.e., "I failed this test, because I did not put enough effort in studying the course material") on college performance were emphasized, in contrast to ability attributions (e.g., "I failed this test because I am not smart enough"). Dispositional optimism was measured prior to the intervention. It was concluded that this intervention decreased voluntary course withdrawal significantly, but only for high optimism students who received attributional retraining.

Martorell and McFarlin (2011) examined the effect of developmental education (as part of the broader Texas Academic Skills Program) on mathematics, reading and writing in 2-year and 4-year study programs in traditional higher education. This was a face-to-face intervention, of which the duration and theoretical underpinning was not specified. This intervention was targeted at basic skills in a number of courses, such as mathematics and language skills. Assignment to the remedial teaching courses was based on diagnostic tests. No detailed description was provided with respect to the remedial teaching itself. Significant results were found in the 2-year study program context only, and showed that fulfilling these remedial courses, in contrast to what expected, lowered the probability of completing at least one year in college by 6%, only when controlling for baseline covariates, such as age, ethnicity, and academic year of enrolment.

Bettinger and Baker (2014), in a randomized experiment, researched the effectiveness of individualized student coaching provided to students in public, private and proprietary universities by a student coaching service called InsideTrack. This intervention was based on three barriers for completion in higher education, identified in prior research: the lack of appropriate information, the lack of students' academic preparation and the lack of integration in the university community. Within the service of InsideTrack (a for-profit provider of coaching services), students are matched to coaches. Coaches contact students on a regular basis, by phone calls, email, text messages and social networking sites, to provide help and support in the beginning of the students' college careers. Coaches working for InsideTrack are hired through a very rigorous application procedure. Phone calls are recorded and coaches receive feedback on the content and tone of their phone calls with students. InsideTrack aims for a 20% institution-specific and 80% general content ratio in the contact between coach and student and in some cases coaches have access to study materials. After 6 and 12 months of this intervention, the persistence rate for coached students was significantly higher than for students who did not receive InsideTrack's coaching. After 18 and 24 months the difference in persistence rates between the coached and control students is still significant at the 1% level, even though the coaching lasted only 12 months. The results do not change when controlling for covariates like ACT/SAT scores, age, high school GPA or scholarship.

De Paola and Scoppa (2014), like Martorell and McFarlin (2011), investigated the effectiveness of mathematics and language skills remedial courses in the context of traditional higher education. This face-to-face intervention lasted two months, and entailed 160 h of remedial teaching. Remedial teaching was implemented at the beginning of the academic year and students were assigned based on their performance on a placement test. Although participation was strongly recommended, it was not compulsory. No detailed description of the remedial teaching was provided. A decrease in non-completion probability between 6 and 13.5% was demonstrated for students attending 100 h of remedial courses, which was statistically significant at the 10% level.

The last intervention study in this category, by Patterson et al. (2014) investigated a face-to-face self-regulated learning course for students in traditional higher education. The duration of this intervention was not specified. Within this self-regulated learning course there was a focus on critical thinking skills and an effort was made to guide students in taking control of their academic lives, aimed at improving students' autonomy. Four self-regulated learning strategies were included: discovering questions pertaining to a course and the methodology for answering them, cognitively engaging with material, identifying teachers' goals and working to meet them, and monitoring one's own comprehension. In addition, students learned techniques to fulfil these strategies, like active reading, creating concept elaborations and developing mock exams. The self-regulated learning course was a 3-credit elective that any undergraduate student could take. This course entailed 50-min lectures twice a week, and weekly meetings in which students showed and discussed their application of self-regulated learning strategies, on which peer monitors provided feedback. Results showed to be significant at the 1% level and indicated that students who completed the self-regulated learning course in the first year were approximately twice as likely to be enrolled in the second year. This effect lasted until the fifth year of college.

3.2.2.2. Peer mentoring. In this category we discuss interventions comparable to the previous category, as they are also on coaching and mentoring. However, in this category we specifically discuss coaching and mentoring provided by peers (trained to serve as a coach/mentor), in contrast to professional teachers, trainers or coaches. Pagan and Edwards-Wilson (2002) examined the effectiveness of a mentoring program for at-risk students (students on academic warning or probation). The mentoring program lasted for one year and was targeted at improving completion rates through improvement of students' academic and interpersonal skills. These factors were, however, not measured in the intervention study. Mentors were selected for an interview from a list of students with high GPA scores and who volunteered to serve as mentors, and eight of them were hired eventually as a mentor. Mentors attended required training sessions, staff meetings and weekly supervision and they received written materials about the theories underlying the mentoring program discussed in the training and meetings. The mentoring program itself consisted of an orientation meeting in which contracts and the goals and responsibilities were discussed. After this meeting, mentors contacted the

mentees via email and personal note cards including information to make a face-to-face appointment. Eventually, if mentees did not make a face-to-face appointment, they were contacted by phone. Overall, mentors met with their mentees at least twice, had contact via email and held phone conversations. During the meetings a specific protocol was followed in which study skills, financial aid, and personal issues were discussed. Statistical analyses of effects were carried out only in relation to GPA of the mentees. Descriptive results reported on non-completion showed that after the mentoring program the status of the 53 students initially on academic warning or probation changed to: 23 students retained in good academic standing, 3 retained on warning, 6 retained on probation and 21 students were academically dismissed.

Salinitri (2005) investigated the effects of a mentoring program in traditional higher education. This mentoring program lasted for one year and was targeted at social and academic integration. In this mentoring program teaching candidates were mentors for first-year students. It was aimed that this mentoring intervention would build networking, skills in self-concept and strengthen the goals of first-year students. The mentors were enrolled in a course in which practices of mentoring, advising and social learning were discussed. Mentors were instructed to journal their activities of the mentor meetings and to write reflective summaries of their experiences. Mentees were asked to assess the mentors' skills by means of the Mentor Assessment Survey. This intervention was executed and evaluated twice. Enrolment as a mentee in the mentoring condition was on voluntary basis. Results showed to be significant at the 1% level, in which in the first run of the intervention a retention rate of 88.5% was found in the group who received mentoring, as compared to 57.1% in the control group. In the second run of the intervention, a retention rate of 71.4% was found for the group who received mentoring, as compared to 23.1% in the group who did not receive mentoring.

Larose et al. (2011) evaluated the effectiveness of a peer-mentoring program in traditional higher education, more specifically, a math, science and technology program. A socio-motivational mentoring model constituted the theoretical underpinning of the intervention which explicitly targeted college adjustment, motivation and career decision. In this peer-mentoring program there were bimonthly meetings between mentors and mentees. Mentors were selected based on previous experience, college performance, and their ability to deal with relationship issues. Mentors and mentees were matched as much as possible according to college, program, professional interests and gender. Mentors were trained in a two-day training seminar and guided by eight supervisors during the implementation of the intervention. Mentors were asked to complete a logbook about the meetings with their mentees. The effectiveness of the program was evaluated by a randomized pre-test/post-test control group design. Motivation, career decision profile and adjustment to college were measured prior and after the intervention by the Academic Motivation Scale, Career Decision Profile Inventory and Student Adaptation to College Questionnaire respectively. After the intervention, mentees showed significantly higher levels of motivation, institutional attachment, social adjustment and a more positive career decision profile, as compared to the students in the (passive) control group. Results demonstrated that this intervention raised completion rates significantly: 86% compared to 76% in the control group.

3.2.2.3. Motivational contact. In this category intervention studies are discussed in which students received motivational support by means of e-mail messages, phone calls or letters. Huett et al. (2008) sent motivational emails and investigated the effect of these emails on withdrawal in both higher online education and traditional higher education. This intervention lasted one course or semester and was targeted at improving completion rates through improvement in ARCS factors (i.e., attention, relevance, confidence and satisfaction), which were measured by the Course Interest Survey. The experimental groups were sent simple, mass-mailed motivational emails throughout the semester, entailing an enthusiastically written introduction (e.g., "I hope you are doing great"), goal reminders (e.g., "Don't forget the deadline for ..."), words of encouragement (e.g., "You can do it"), and multiple points of contact (e.g., "Do not hesitate to contact ..."). This intervention showed to be significant at the 5% level, but only in the online context.

Simpson (2008) also investigated the effect of motivational emails, supplemented by motivational telephone contact and letters, in a higher online educational context. This intervention lasted one course, and was based on a broad range of theories, among which ARCS factors, self-determination theory, and the strength approach. The content and procedures of the telephone and email contact were not further specified. It was discussed that motivational telephone contact only increased retention by around 5% and the combination of motivational emails, letters and telephone contact increased retention by around 25 percentage points.

Inkelaar and Simpson (2015) evaluated the effect of motivational emails only in higher online education, in an intervention that lasted approximately six months. The theoretical underpinning mentioned for this intervention was, like in the two studies discussed previously the ARCS factors, theories of self and positive psychology. Motivational emails were sent biweekly, comprised messages of around 400 words, were addressed personally to a student (instead of 'Dear student'), were signed by a person designated as 'University of London Learning Consultant' and were written in an informal friendly style containing suggestions about learning and overcoming learning problems. The emails were called 'Study Tips' and seventeen topics were addressed in a corresponding number of emails. For example, motivating yourself to learn, making lists, learning to concentrate on learning and exam tactics. A monitor showed that approximately 37.3% of the recipients on average opened the emails. This intervention appeared to be significant at the 10% level only, and an increase of 2.3 percentage points in retention was presented.

3.2.2.4. Academic dismissal policies. In this category interventions are discussed in which there is a form of 'selection after enrolment', by means of academic dismissal (AD) policies. Important to keep in mind reading these results is that they were partly based on the same data. Stegers-Jager and colleagues (2011) evaluated an academic dismissal policy implemented in a specific context of medical education. Two AD cohorts were compared to two non-AD cohorts on several outcomes, among which dropout rates and year 1 curriculum completion. This intervention consists of two components. First, students were warned when they failed to meet set standards. In addition, students who were warned were offered academic support meetings on a voluntary basis. The results showed that there was a significant difference in dropout rate in terms of completing the first year curriculum (measured 2 years after

enrolment). The effect size was 0.07.

Arnold (2015) examined the effectiveness of academic dismissal policies in Dutch (traditional) universities in cohorts from 2002 till 2007. In academic dismissal policies in the Netherlands a binding study advice is given, based on the number of study credit points obtained during the first year in university. Below a certain threshold of attained study credits students receive a negative, binding study advice. Students who obtained the maximum amount of credits receive a positive advice and students in between the threshold and the maximum receive a conditional positive study advice. This means in most of the cases that these students have to obtain all first year credits before the end of the second year. In most institutes students who received a negative binding study advice are provided support in their transition to another degree program. The function of these academic dismissal policies is twofold. On the one hand these policies have a selective function (i.e., “preventing students from spending too much time in pursuing a study for which they do not have the skills, talent or motivation”, p. 1071). On the other hand, it has a referential function (i.e., “putting students in the right track in time”, p. 1071). The results showed that overall the academic dismissal policies increased non-completion in the first year by an average of 6–7%. However, completion rates after four years improved by 5–9%. Overall, first year dropout rate for students in AD cohorts is 35.8%, compared to 27.9% for students in non-AD cohorts. These differences are significant at the 1% level.

Sneyers and De Witte (2017) also investigated academic dismissal policies in the Netherlands, for both research universities and universities of applied sciences (both traditional higher education), for cohorts from 2003 to 2004 and 2008–2009. Their results are in line with the results from Arnold (2015) and suggest that the implementation of an academic dismissal policy results in higher first-year non-completion, but also a higher graduation rate (completion rate after four years). Significant at the 0.01% level, they showed that first-year non-completion will increase by 7.5% by implementation of an academic dismissal policy.

3.2.2.5. Interventions on instruction. In the last category of interventions we discuss intervention studies focussing on the effect of changes in instruction and delivery method of education on completion rates. Chung (2001) investigated the combined effect of diverse systematic instructional methods in online courses as an intervention to raise completion rates. In total the study mentions 28 instructional methods linked to the ARCS constructs. For instance, class sizes were kept small (about 17 students), learners were provided with a technical training program, clearly stated weekly goals were provided, personal contact was made with each learner through a personal discussion area online or email, and multimedia materials were used in instruction. The intervention lasted one course or semester and the ARCS variables were measured prior and after the intervention. The questionnaires were filled by 12–20 participants, yet it was not specified on how many students the figures on retention were based. Results showed that before the intervention was implemented 44% of the students dropped out of the program by their third course. After the first cycle of implementation this figure decreased to 22% and a further 15% in subsequent years.

3.2.3. Synthesis of characteristics of effective and efficient interventions

The second aim of this review study was to gain insight in the characteristics of effective and efficient interventions to raise completion rates in higher education. In Fig. 5 we present the effectiveness and characteristics (see section 2.2) of all categories of interventions included in this literature. Even though cost-effectiveness might be an important characteristic to take into

Characteristics	Interventions				
	Coaching & Remedial teaching (K**=6)	Peer mentoring (K=3)	Motivational contact (K=3)	Academic dismissal policies (K=3)	Interventions on instruction (K=1)
Impact on completion rates	↑ Increasing	↑ Increasing	↕ Inconsistent	↓ Decreasing	↑ Increasing
Effect size (Cohen's d)	⊕ Unknown	⊕ Unknown	⊕ Unknown	0.07	⊕ Unknown
Effect (min. and max. difference between groups or cohorts)	6% 54%	10% 48%	2% 25%	7% 8%	7% 22%
Duration (min. to max.)	One session One year	One semester One year	One course One semester	One year	One course One semester
Mode of intervention (online, face-to-face or blended)	⊕ Face-to-face ⊕ Online	⊕ Blended ⊕ Online	⊕ Online	⊕ Blended ⊕ Online	⊕ Online
Educational context (online or face-to-face educational context)	⊕ Face-to-face	⊕ Face-to-face	⊕ Face-to-face ⊕ Online	⊕ Face-to-face	⊕ Online
Target factor(s)*	⊕ ⊕ ⊕	⊕ ⊕	⊕	⊕ ⊕ ⊕	⊕

Fig. 5. Synthesis of characteristics of effective and efficient intervention studies.

* Target factor(s) are based on the categories of the first part of this literature review, see Fig. 4.

**K is the number of intervention studies included in the corresponding category.

consideration during design of an intervention, it is not taken into account in Fig. 5, as in all categories of interventions information regarding this characteristic was lacking. All in all, interventions raising completion rates significantly are coaching or remedial teaching and peer mentoring, in which the differences between experimental and control groups or cohorts before and after implementation of interventions range from 6 to 54 percentage points. Academic dismissal policies decrease completion rates in the first year (an effect size of 0.07 reported by Stegers-Jager and colleagues, 2011), but by selection after student enrolment increasing completion rates in the long run (i.e., graduation rates after 4 years).

All in all, coaching and remedial teaching interventions aim at increasing completion rates through improvement of mostly dispositional cognitive (e.g., self-regulated learning skills, basic competences such as mathematics) and non-cognitive (e.g., academic motivation, attributions) factors, although one intervention also focused on situational factors (i.e., time commitments outside students' school lives). The interventions in this category included in this literature review are evaluated in the context of traditional higher education mainly. However, Bettinger and Baker (2014) investigated coaching intervention in the context of public, private and proprietary higher education, which also concerns (adult) students combining their study program with a job, comparable to the student population in higher online educational contexts. The majority of coaching and remedial teaching interventions raise complete on rates significantly, although for some of the interventions these results were conditional, for instance, significant in subgroups only. One intervention even decreased completion rates in 2 year community college samples. Coaching and remedial teaching interventions in general have the lowest minimum duration, lasting only one informal session of 30 min, of all interventions included in this review study. Differences between experimental and control groups or cohorts before and after implementation of these interventions of in this category are ranking highest of all interventions in this literature review.

Peer mentoring programs seem to significantly improve completion rates in higher education, but the peer mentoring studies included in this literature review are executed in traditional higher education only, so we cannot draw any conclusions on the impact of these interventions on completion rates in higher online education. The factors focused on in these interventions are merely dispositional non-cognitive (i.e., academic and social integration), although Pagan and Edwards-Wilson (2002) focused on dispositional cognitive factors as well (i.e., study skills). With respect to duration, these interventions with a minimum duration of one semester not as short as the shortest coaching and remedial teaching intervention in this literature review, and last at maximum duration as long as interventions in other categories as well. Effects of these interventions are comparable to the effects of coaching and remedial teaching and motivational contact. One peer mentoring program was stated to be cost effective (Salinitri, 2005), but to draw conclusions on the cost effectiveness of this category, more information is needed, although in comparison to mentoring programs in which students are mentored by university staff or externally hired mentors, peer mentoring might be less expensive.

Motivational contact interventions are mostly implemented and evaluated in the context of higher online education, although in one of the interventions there was a face-to-face condition as well (Huett et al., 2008). These interventions show inconsistent results with respect to increasing completion rates. These interventions are aimed at increasing completion rates through improvement in dispositional non-cognitive factors. According to the researchers of the interventions included in this category of the present literature review, these interventions are cost effective.

Academic dismissal policies, in contrast to the other categories, increase non-completion rates in the first year of higher education. However, by selection after student enrolment these interventions increase graduation rates. However, graduation rates were not the main outcome measure in this review, and therefore makes it hard to compare results of academic dismissal policies to those of the other intervention categories. The interventions in this category included in this literature review have only been investigated in the context of traditional higher education, which means we cannot draw conclusions on whether these interventions do have impact on completion rates in higher online educational contexts as well.

In the category of interventions on instruction only one study was included in the present literature review, which means we cannot draw conclusions on interventions on instruction in general, as we cannot compare results of different intervention studies in this category. It also makes it difficult to compare the results of this category of interventions to the other categories. The specific study in this category included in the present literature review was carried out in the context of higher online education, but there are, of course, diverse interventions on instruction possible both higher online educational contexts as well as traditional higher education (e.g., education delivery method, problem-based learning).

4. Discussion

A vast body of previous research has aimed at explaining the non-completion problem by investigating predictors of non-completion. Interventions aimed at increasing completion rates should be built upon the research on predictors of non-completion (i.e., as this research points out where there is room for improvement), and take into account lessons learned from previously evaluated interventions.

Drawing on 10 review studies we identified consistent significant effects for the following modifiable predictors of non-completion in higher education: entry qualifications, study- or learning strategies, academic adjustment/adaptation and involvement, goals and intentions, academic self-efficacy, employment, supportive network and faculty-student interaction. Based on effect sizes and consistent results only, the most effective modifiable predictors for non-completion based on these review studies seem to be study-/learning strategies or skills (estimated true correlation of 0.366, see Robbins et al., 2004), academic self-efficacy (estimated true correlation of 0.359, see Robbins et al., 2004), academic goals and intentions (estimated true correlation of 0.340, see Robbins et al., 2004). Estimated true correlations of 0.206–0.230 were reported for academic adjustment/adaptation and involvement (Credé & Niehorster, 2012; Robbins et al., 2004).

Drawing on 16 intervention studies, we found that interventions significantly increasing completion rates in higher education are coaching (i.e., motivational), remedial teaching on basic competences as mathematics and writing skills, and peer mentoring. These

interventions focus on dispositional cognitive factors, dispositional non-cognitive factors and situational factors. Inconsistent results were found for the effectiveness of motivational contact on completion rates in higher education. Additionally, results on the effectiveness of interventions on instruction are hard to interpret, as actually multiple interventions were evaluated at once and there was only one intervention study included in this category. Academic dismissal policies appear to decrease completion rates in the first year, but thereby increase completion rates in the long run. In terms of the possible strategies to raise completion rates, as discussed in the introduction, we could say that academic dismissal policies constitute a third strategy: reducing 'enrolled numbers' by making a definite calculation of enrolled numbers only after the first year. However, such an approach is not without ethical implications, as it might be possible to draw conclusions on the risk of not completing a course or study program earlier in the first year of higher education, or even before student enrolment (e.g., see Fonteyne & Duyck, 2015), when prospective students or newly enrolled students are still in a position to adjust their study decision and/or study behaviour. Providing valid tools (e.g., diagnostic assessments) prior to student enrolment identifying 'weak spots' or barriers affecting chances for completion, with the aim to enable students to better prepare and/or adjust their decision (rather than select), might be a solution in that direction. Especially in distance universities, often characterized by an open access policy combined with high demands in terms of motivation, discipline and self-regulation, 'expectation management' is the predominant aim, rather than selection. Obviously, independent of questions of selection and timing, any diagnostic tools should be developed and deployed with great care so as to rule out, false negatives, i.e. the possibility of discouraging or dismissing students who in fact stand a real chance of completion.

Interesting is that of the 16 intervention studies included in the present literature review, only four were fully targeted at what appeared to be modifiable consistent predictors of non-completion in the first part of our literature review. Of the 16 included intervention studies, 14 at least partly targeted those modifiable consistent predictors of non-completion. However, the majority of these 14 merely focused on other factors that were not demonstrated as modifiable consistent predictors of non-completion in our review. There is thus only limited explicit alignment between the research on interventions aimed at raising completion rates in higher education and significant relevant predictors of non-completion in higher education as demonstrated in prior research. As stated by Chung (2001), we also believe that a more systematic approach is needed to resolve the non-completion problem, which means that educational institutions systematically design and carry out interventions. This advocates for a more design-based research approach (Plomp, 2013, pp. 11–50), in which interventions are based on results of a needs-assessment first (i.e., take into account where there is room for improvement and what modifiable factors are relevant) and are evaluated in a cyclic manner. As Martens (2018) states, there is a need for educational research in which there is a systematic collaboration between different stakeholders (e.g., practitioners and researchers). To solve complex problems such as the non-completion problem in educational practice, educational research should be conducted in the context in which a solution for the problem is demanded. The interventions carried out in the context of higher *online* education showed either inconsistent results (i.e., motivational contact interventions) or were hard to interpret, as multiple interventions were investigated simultaneously and in one study only (i.e., interventions on instruction). The interventions that have been found to significantly increase completion rates are carried out in the context of traditional higher education only, even though the mode of the interventions in some cases was (partly) online. These interventions merit further investigation to establish their possible impact in the context of higher *online* education, and under which conditions.

4.1. Limitations of the present review and directions for future research

First, although we gained insight in relevant modifiable predictors of non-completion and to some extent, characteristics of interventions raising completion rates, using these results to develop interventions to raise completion rates in higher education, and higher *online* education specifically should, be made with some caution. With respect to predictors of non-completion, we cannot simply assume that the same factors apply to the same extent in higher online education as they do in traditional higher education. This means that interventions based on factors relevant for traditional higher education, might be less effective (or not effective at all) in higher online education, for instance due to the higher proportion of adult learners, for whom situational factors (e.g. job, parenting) might play a much bigger role. This is something to take into consideration not only in explaining the non-completion problem, but also in designing interventions for different target groups. Moreover, the way factors should be operationalized possibly differs between educational contexts. The construct motivation in a group of prospective traditional higher education students, currently leaving high school, is likely to be different in a group of adult learners, picking up a study course or program years (or maybe even decades) after leaving high school, combining it with several other roles, such as a job or parenting.

Second, there are several points that should be taken into account when designing and evaluating new interventions aimed to raise completion rates in higher education. First, in contrast to the vast body of literature on predictors of non-completion in higher education, scientific literature on interventions is rather scarce, in particular on interventions prior to enrolment. In result, a publication bias might have influenced our results, as we only included peer-reviewed articles published in academic journals. Especially for the overview of interventions this might have played a role, as a lot of educational institutions do design and evaluate initiatives to raise completion rates, but do not publish about the outcomes of these initiatives in (peer-reviewed) scientific journals (Simpson, 2010). Instead these initiatives appear more likely to be reported about in popular scientific journals (for an example, see Schlusmans & Winkels, 2017), or in policy documents. In addition, as mentioned in the introduction, in the field of study success there is often a broad range of terms used for a similar concept or definition. This means our search terms might not have been all-encompassing in finding relevant peer-reviewed scientific articles on interventions to raise completion rates. In addition, it is noticeable that we did not find any articles in regard to learning analytics, as it has been argued that learning analytics are promising in predictive research and it is an emerging field in interventional research (Rienties Boroowa, Cross, Muliak, Mayles, & Murphy, 2016). For both parts of the present literature review it might be that our search terms have not been all encompassing in this respect, as we did not look for

learning analytics studies in particular. For the part on predictors of the present review we focused on prior review studies only. In that sense, it might be that there are no review studies involving learning analytics yet, meeting our inclusion criteria. For the part on interventions in the present review, we searched for interventions purposely designed to increase completion rates in higher education. A great deal of work and research has been done in the field of learning analytics. However, the translation into concrete and theoretically grounded interventions has yet to be made (Jivet, Scheffel, Drachsler, & Specht, 2017).

Finally, the interventions included in the present literature review are all interventions implemented after enrolment. Despite an additional literature search with search terms for pre-enrolment interventions specifically. These kinds of interventions are, for instance, initiatives to make sure students start a study course or program with the appropriate expectations or an appropriate level of knowledge and skills in order to raise the odds for completion. This does not necessarily mean that these kinds of interventions are not implemented by educational institutions. It does, however, indicate that they have received less academic attention than interventions implemented after enrolment.

The focus of future research should be twofold. Future research should focus on how the predictors of non-completion (in interaction with each other) explain the non-completion problem, especially with respect to a higher *online* educational context. Additionally, (isolated) factors should be targeted in interventions to investigate the effectiveness in raising completion rates in higher education. Moreover, intervention studies included in the present literature review were limited in their alignment with research on predictors of non-completion. To build a knowledge base on resolving non-completion, more academic attention is required for interventions aimed at raising completion rates in higher education, especially interventions implemented prior to student enrolment. Besides, more systematic research is needed to design, implement and evaluate interventions to raise completion rates incrementally, step by step, based on prior research on predictors of non-completion.

5. Conclusion

In conclusion, non-completion in higher education is a multidimensional problem, in which a broad range of (modifiable) factors provide some predictive value, depending on the context in which they are investigated. Although the results are still rather indefinite and results are somewhat limited for the context of higher *online* education, we gained relevant insight in modifiable predictors of non-completion in higher education. Entry qualifications, study- or learning strategies, academic adjustment/adaptation and involvement, goals and intentions, academic self-efficacy, employment, supportive network, and faculty-student interaction appear to be relevant modifiable predictors of non-completion in the context of higher education.

In addition, we gained insight in characteristics of interventions increasing completion rates in higher education and the extent to which these interventions are calibrated with research on predictors. Coaching, remedial teaching, and peer mentoring appear to be very promising. However, the alignment with research on relevant predictors of non-completion is limited. Furthermore, interventions require further investigation in the context of higher *online* education and more academic attention is required for interventions prior to student enrolment.

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.edurev.2020.100313>.

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- References included in the part on predictors of non-completion are marked with *
- References included in the part on interventions to raise completion rates are marked with **
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