What is online learner participation? A literature review

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ABSTRACT

It is commonly argued that a key challenge for e-learning is to encourage learner participation. Even though this challenge has received increased attention by researchers, little effort has been put into developing a sound theoretical understanding of what online participation actually is and how it may be studied empirically. This paper examines the conceptions and research approaches that underlie research on online participation in e-learning settings. A classification scheme was iteratively developed and used when publications on the topic were reviewed. It was found that research is dominated by low-level conceptions of online participation, which relies on frequency counts as measures of participation. However, some researchers aim to study more complex dimensions of participation, such as whether participants feel they are taking part and are engaged in dialogues, reflected by using a combination of perceived and actual measures of participation. In conclusion, a definition of online learner participation that acknowledges its more complex dimensions, such as doing, communicating, thinking, feeling, and belonging, is proposed.

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1. Introduction

Participation has been argued to be an intrinsic part of learning (Wenger, 1998). A key challenge for e-learning, defined as learning and teaching facilitated online through network technologies (Garrison & Anderson, 2003), is to encourage participation (Bento & Schuster, 2003). It is commonly argued that learner participation may be enhanced by using computer-mediated communication media in both traditional and e-learning settings (Harasim, 1989; Haythornthwaite, 2002; Leidner & Jarvenpaa, 1995). Almost as long as computer-mediated communication media has been used, researchers have tried to understand how online participation may be encouraged. Previous research has shown that participation, measured as interaction with peers and teachers, has a positive effect on perceived learning, grades and quality assessment of assignments (e.g., Fredericksen, Picket, Shea, Pelz, & Swan, 2000; Hiltz, Coppola, Rotter, Turoff, & Benbunan-Fich, 2000). Furthermore, it has been argued that participation influences learner satisfaction (Alavi & Dufner, 2005) and retention rates (Rovai, 2002) positively. Interestingly, many researchers seem to agree on that online participation is a key driver for learning even though their perceptions of how online participation may be conceptualised is very different. Let me illustrate this by comparing two recent studies.

In the first study, Davies and Graff (2005) examined the relationship between the level of online participation and grade. The students' accesses to group and communication areas were combined and used to represent the degree of participation. Among other findings, it was concluded that "students who failed in one or more modules did interact less frequently than students who achieved passing grades" (p. 663). In the second study, Vonderwell and Zachariah (2005) searched for factors that influence learner participation. Their study included both perceived and actual measures of participation, collected

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through surveys, learner reflections and content analysis of communication. The findings "indicated that online learner participation and patterns of participation are influenced by the following factors: technology and interface characteristics, content area experience, student roles and instructional tasks, and information overload" (p. 213).

What can then be learnt about online learner participation from the two studies above? First, one needs to consider how participation was studied. If one believes that participation is a complex phenomenon that needs to be measured by using both perceived and actual measures, as in the second study, it may be argued that the first study investigates online access rather than online participation. Surprisingly, little effort has been put into developing a sound theoretical understanding of what online participation actually is and how it may be studied empirically. The aim of this paper is to address this problem by reviewing how online participation has been conceptualised and studied in e-learning settings. It concludes with suggestions to guide future research, which includes proposing a definition of online learner participation.

The paper is organized as follows. First, there is a description of the research procedure, including a discussion on how the publications to be included in the review were selected and analysed. Then, conceptions of online participation in the e-learning literature are discussed. This is followed by a description of the research approaches that have been adopted when studying online participation. Finally, the findings are discussed, limitations are acknowledged, further research is suggested and conclusions are put forward.

2. Procedure

In order to identify papers that aim to measure online learner participation, a literature review was conducted. As suggested by Webster and Watson (2002), it was searched broadly for publications on the topic rather than limiting the search to specific years or journals. Such a limit might have influenced the findings subjectively since: (1) research follow trends and thus specific research approaches might have been more common during certain time-periods; and (2) specific journals might encourage particular research approaches (Hrastinski & Keller, 2007).

The literature review was initiated by conducting a literature search in the Education Resources Information Center (ERIC) database in March 2008. The ERIC database includes well-known journals on e-learning published by organisations, such as Elsevier and Routledge, and is usually considered as the most important database when identifying educational literature (Hertzberg & Rudner, 1999). Since e-learning research lies in the intersection between technology and education, publications that mainly concerned education in traditional settings could easily be removed. However, if a database with a wider scope, such as the ISI database, had been chosen, the process of identifying publications in the intersection of these areas would have been more complex. It was searched for journal publications that included the words "participation" or "participate" in the title since these were assumed to examine some aspect of participation. In total, 2253 papers that included "participation" or "participate" in the title were identified and 31 of these, which were written in 1996 or later, examined online learner participation.

During the second phase of the literature review, literature searches were conducted by using the ISI database to ensure that key articles had not been overseen. In addition, the bibliographies of the identified articles were searched to decrease the likelihood that key articles were overlooked. A vast amount of research concerns online learner participation in some way or another. It may be argued that articles on closely related concepts, such as computer-mediated communication, online community and collaboration, web 2.0 and online social networks, should have been included in the review. However, it was decided to only include articles that had the words "participation" or "participate" in the title since these were assumed to focus on the concept that I wanted to scrutinize. Moreover, it would not have been possible to complete such a review if it was not limited to specific search criteria. A downside of the chosen approach is that some useful articles probably were not identified. For example, Picciano (2002) discusses participation but he did not include the words "participation" or "participate" in the title. In total 36 articles were selected, which are listed in Appendix A.

3. What is online learner participation?

In this section, examples of how online learner participation has been conceptualised, derived from the review of studies, is discussed. From the review it is clear that researchers' perception of the complexity of online participation varies very much. Six levels iteratively emerged while reviewing the selected articles (see Table 1 and Appendix A). They were intended to describe the different ways in which online learner participation has been conceptualised.

3.1. Level 1: participation as accessing e-learning environments

First level conceptions of online participation are characterized by that participation is equalled with the number of times a learner access an e-learning environment, i.e. a learner that access an e-learning environment many times is assumed to participate more actively than a learner who does not. Davies and Graff's (2005) study is an example of a first level conception of participation: "The students' access to the group area and their access to the communication areas were combined and used to represent the degree of participation" (p. 658).

Table 1
Conceptions of online learner participation

Level		No. of papers	Percent of papers
1	Participation as accessing e-learning environments	1	3
2	Participation as writing	10	28
3	Participation as quality writing	9	25
4	Participation as writing and reading	2	6
5	Participation as actual and perceived writing	2	6
6	Participation as taking part and joining in a dialogue	12	33
Total		36	100

3.2. Level 2: participation as writing

Second level conceptions of online participation are characterized by that participation is equalled with writing, i.e. a learner that writes many messages or many words is assumed to participate more actively than a learner who does not. An example of this category of approaches is provided by Lipponen, Rahikainen, Lallimo, and Hakkarainen (2003): "The definition of who is active and who is inactive in the class was made on the basis of percentile values; a participant was considered active if the participation rate (number of written notes) was in the upper quartile and inactive if it was in the lower quartile" (p. 492).

3.3. Level 3: participation as quality writing

Third level conceptions of online participation are characterized by that participation is equalled with writing contributions of high quality, i.e. a learner that writes many contributions of high quality is assumed to participate more actively than a learner who does not. For example, Davidson-Shivers, Muilenburg, and Tanner (2001) conducted a qualitative analysis and identified nine types of substantive and non-substantive comments (e.g., responding and reacting statements).

3.4. Level 4: participation as writing and reading

Fourth level conceptions of online participation are characterized by that participation is equalled with writing and reading, i.e. a learner that writes and reads many messages is assumed to participate more actively than a learner who does not. A definition is provided by Lipponen et al. (2003), even though it should be noted that they chose not to examine the number of read messages in their study: "One can define at least two forms of participation in CSCL [computer-supported collaborative learning] environments: writing notes and reading notes ('lurking')" (p. 492).

3.5. Level 5: participation as actual and perceived writing

Fifth level conceptions of online participation are characterized by that participation is equalled with actual *and* perceived writing, i.e. a learner that writes many messages that are perceived of importance is assumed to participate more actively than a learner who does not. This conception is explained by Mazzolini and Maddison (2003), when discussing the limitations of their study:

"This particular study was motivated mainly by an assumption that the participation rate by students, plus the length of discussion threads, might provide some simplistic measure of the quality of the discussion forum interactions. However, this assumption may not tally with students' perceptions of whether discussion forums are in practice a useful part of an online program." (Mazzolini & Maddison, 2003, p. 241)

3.6. Level 6: participation as taking part and joining in a dialogue

Sixth level conceptions of online participation are characterized by that participation is related with taking part and joining in a rewarding dialogue, i.e. a learner that feels that he or she is taking part and is part of a rewarding dialogue is assumed to participate more actively than a learner who does not. Vonderwell and Zachariah (2005) provide an example of a conception belonging to the sixth level:

"In this article, the authors define participation as taking part and joining in a dialogue for engaged and active learning. Participation is more than the total number of student postings in a discussion forum." (p. 214)

Table 2
Reviewed articles by type of communication, method and unit of analysis

	No. of papers	Percent of papers
Type of communication		
Asynchronous	28	78
Synchronous	4	11
Mixed	4	11
Method		
Quantitative	13	36
Qualitative	3	8
Mixed	20	56
Unit of analysis		
Quantity of messages or units	27	75
Message or unit quality	17	47
Learner perceptions	14	39
Message lengths	7	19
System accesses or logins	5	14
Read messages	3	8
Time spent	3	8
Total	36	100

By studying Appendix A, it is apparent that sixth level conceptions of online participation have been increasingly common in recent years. Since 2005, 7 out of 13 articles (54%) were characterized by this conception.

4. Approaches for studying online learner participation

An initial classification scheme was developed prior to examining the research approaches of the reviewed studies. Two pairs of categories were decided on beforehand: (1) asynchronous and/or synchronous communication, and (2) quantitative and/or qualitative method. The first set of categories tell us what types of communication that were examined while the second set of categories give an indication of the types of approaches that underlie research. A number of categories iteratively emerged while reviewing the selected articles. They were intended to describe how online participation is empirically studied.

As displayed in Table 2, most of the reviewed studies adopted mixed (56%) or quantitative (36%) methods whilst few were of a qualitative nature (8%). A vast majority of the papers examined participation by text-based media. Most studies (78%) examined asynchronous communication, mainly the use of discussion board, while few examined synchronous (11%) or mixed communication (11%) approaches. Since the emphasis of research has been on the use of discussion board, the research approaches reported here are biased toward such communication. By iteratively reviewing the articles, the following units of analysis emerged, which are discussed below: the number of messages or units, message or unit quality, learner perceptions, message lengths, system accesses or logins, read messages and time spent.

4.1. Quantity of messages or units

The most common measure of online learner participation has been the quantity of messages or units. The term message is used to describe both what some would label postings and "chat lines". Most studies reported the number of messages. The remaining studies divided data from logs into units such as: (1) words, phrases, or sentences (e.g., Böhlke, 2003); (2) complete statements or thoughts (e.g., Davidson-Shivers et al., 2001); or (3) ideas (e.g., Hakkarainen & Palonen, 2003). The frequency of messages or units has been used to compare frequencies for: (1) individual learners, groups or classes (including treatment groups); (2) groups of learners by characteristics (e.g., gender, learning styles); (3) types of messages (e.g., sent and received messages); (4) time-periods; and (5) different forums (e.g., "academic" vs. "social" forums). A different approach is advocated by a group of Finnish researchers (Hakkarainen & Palonen, 2003; Lipponen, Rahikainen, Hakkarainen, & Palonen, 2002; Lipponen et al., 2003) whose studies are guided by social network analysis (Wasserman & Faust, 1994). By analysing logs of communication, they compute measures such as the density of communication and the "centrality" of different participants.

4.2. Message or unit quality

The second most common unit of analysis, which is of a more qualitative nature, has been message or unit quality. Most studies categorized each message or unit according to a classification scheme. There is no established scheme – all

examined studies used different schemes. The most common comparison was between on-topic and off-topic messages (e.g., Davidson-Shivers et al., 2001; Lipponen et al., 2002) and type of interaction such as asking questions, providing information etc. (e.g., Carr, Cox, Eden, & Hanslo, 2004). When also evaluating the topic of messages, researchers may engage in more in-depth comparative analyses of message topics: (1) written by men and women (e.g., Ross, 1998); (2) written by instructors and learners (e.g., Poole, 2000); or (3) in asynchronous and synchronous settings (e.g., Davidson-Shivers et al., 2001). Other approaches include assessing the level of critical thinking in messages (e.g., Bullen, 1998) and how a learner influences a group (Ross, 1996). In all but two studies, one or several researchers would study all or a sample of messages or units and then classify them according to a scheme. The exceptions are Dennen (2005) who observed discussion forums and then reported an assessment of the quality of participation in different courses and Williams and Pury (2002) who examined this unit of analysis by asking learners what kind of topics that were discussed in a survey.

4.3. Learner perceptions

The third most common unit of analysis has been learner perceptions. This approach has been increasingly common in recent research. As already mentioned, some of the units of analysis discussed above have been measured as learner perceptions. The approaches for studying perceived participation have included interviews (e.g., Bullen, 1998); reflective learner reports (Ellis, 2003) and, closed-ended (Hrastinski, 2006) and open-ended questions in surveys (Kuboni & Martin, 2004). Bullen (1998) analyzed how and why students participated and, similarly, Olofsson (2007) examined how and why learners became participants in educational online learning communities. Ellis (2003) asked students to write reflective reports on their experience in online forums where they not only described but also attempted to explain their experiences. Hrastinski (2006) used closed-ended questions to, for example, map the social networks of students, in order to understand how students participate in communities. Finally, Kuboni and Martin (2004) included an open-ended question as a complement to closed items in a questionnaire.

4.4. Message lengths

In seven of the reviewed publications, the unit of analysis was message lengths. The length of messages has been reported as word counts (e.g., Woods & Keeler, 2001) or lines of information (e.g., Masters & Oberprieler, 2004). The measure has been used to report average text counts for: messages (Masters & Oberprieler, 2004), dialogue acts (Janssen, Erkensa, Kanselaara, & Jaspersa, 2007), messages during specific time-periods (Poole, 2000), individual learners (Poole, 2000), classes (e.g., Masters & Oberprieler, 2004), males and females (e.g., Ross, 1998), learners of different sociocultural background (Prinsen, Volman, & Terwel, 2007) and different treatment groups (Woods & Keeler, 2001). It has also been used to calculate the volume ratio, i.e. the amount of text produced by a learner as compared with the total body of text (Ruberg, Moore, & Taylor, 1996). Instead of using the word counts of all messages, Ross (1996) only included messages that were identified as productive and substantive contributions.

4.5. System accesses or logins

In five of the reviewed publications, the unit of analysis was system accesses or logins. Three of the studies measured participation by how often learners accessed areas where online discussions occurred (Caspi, Chajuta, & Saportaa, 2008; Davies & Graff, 2005; Poole, 2000) and the remaining two studies by how many times learners had logged on (Ellis, 2003; Kuboni & Martin, 2004). System accesses have been reported as average hits for each learner and for a class (Poole, 2000). Average logins have been used when comparing learners by gender (Caspi et al., 2008), learning styles (Ellis, 2003) and grades (Davies & Graff, 2005). Finally, this unit of analysis has also been measured as learner perceptions by a survey (Kuboni & Martin, 2004).

4.6. Read messages

In three of the reviewed publications, the unit of analysis was read messages. Read messages has been reported as the average read count for each learner and for a class (Poole, 2000). In one of the studies, the relationship between the number of sent and opened messages in general and when comparing gender and different courses was explored (Masters & Oberprieler, 2004). Finally, this unit of analysis has also been measured as learner perceptions by a survey (Williams & Pury, 2002). An assumption of these studies, that the number of messages that have been opened equal the number actually read, may be questioned.

4.7. Time spent

In three of the reviewed publications, time spent was used as unit of analysis. It was measured as learner perceptions by using surveys. Hrastinski (2006) and McLinden, McCall, Hinton, and Weston (2006) asked students to estimate how many hours they spent engaged in different activities, such as interpersonal communication and working with course content. Similarly, Kuboni and Martin (2004) asked students to estimate the frequency and average length of each visit when using an e-learning environment.

5. Discussion

In this paper, six levels of conceptions of online learner participation, ranging from regarding participation as accessing e-learning environments to emphasizing taking part and joining in a dialogue, were identified. Moreover, the most common research approaches for studying online participation, ranging from simple frequency counts to learner perceptions, were identified. In Table 3, units of analysis that have been used in research on the six levels of conceptions of online learner participation are presented. There are benefits and limitations associated with each of the identified conceptions and approaches. For example, if assuming that participation can be equaled with the number of written messages, this can be easily monitored in e-learning environments. However, if acknowledging participation as a complex phenomenon, it becomes more difficult to measure participation: "Interaction may indicate presence but it is also possible for a student to interact by posting a message on an electronic bulletin board while not necessarily feeling that she or he is a part of a group or a class" (Picciano, 2002, p. 22). Computer-mediated communication has a many-to-many, rather than a one-to-one form (Harasim, 1989). Learners write contributions directed not only to the teachers but also to fellow learners. An implication of the many-to-many form is that it is assumed that learners might benefit from reading or listening to their peers. However, most of the reviewed studies have been characterized by conceptions and research approaches, which equal participation with writing. Low-level conceptions of online learner participation do not recognize the more complex dimensions of online participation.

A commonly held assumption that some researchers have increasingly come to challenge is that learners in online settings only participate by writing (Hrastinski, 2007; Romiszowski & Mason, 2004; Vonderwell & Zachariah, 2005). Those that contribute "too little" are labelled "lurkers" or "passive recipients rather than actively engaged in learning" (Romiszowski & Mason, 2004, p. 399). Many evaluative studies report "expressions of delight at hearing other expressing the same worries or confusions or criticism" (Laurillard, 2002, p. 150). Much reading is not passive since it may encompass engagement, thought and reflection (Romiszowski & Mason, 2004). The concept of "vicarious learning" recognizes the fact that learning may occur through observation of other learners engaged in active dialogues (McLendree, Stenning, Mayes, Lee, & Cox, 1998), as maintained by Kolb (1984). Even though most of the studies relied on measures of the quantity of interactions as a measure of participation, several of them acknowledged limitations of this approach (e.g., Mazzolini & Maddison, 2003; McLean & Morrison, 2000) and have called for better measures of online participation:

> "Although the rate of student participation and the length of their discussion threads may be common intuitive ways used by instructors to judge the 'health' of their discussion forums, it is far from clear from this study that they are useful measures to judge the quality of the learning taking place there." (Mazzolini & Maddison, 2003, p. 252)

Possible research frameworks for studying high-level conceptions of online learner participation include social perspectives on learning (e.g., Vygotsky, 1978; Wenger, 1998). Wenger defines participation as "a process of taking part and also to the relations with others that reflect this process" (p. 55). He views participation as a complex process that combines doing, talking, thinking, feeling and belonging. Wenger argues that learning and participation are not separate activities that can be turned on and off. Thus, it should be clarified that we may participate socially even at times when we are not engaged in a conversation with someone:

Table 3
Conceptions of online learner participation and units of analysis

Unit of analysis	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Quantity of messages or units		√	√	√	√	√
Message or unit quality			√	√	√	√
Learner perceptions			√		√	√
Message lengths		√	√	√	√	√
System accesses or logins	√	√	√	√	√	√
Read messages				√		√
Time spent					√	√

"From [Wenger's] perspective our engagement with the world is social, even when it does not clearly involve interactions with others. Being in a hotel room by yourself preparing a set of slides for a presentation the next morning may not seem like a particularly social event, yet its meaning is fundamentally social. Not only is the audience there with you as you attempt to make your points understandable to them, but your colleagues are there too, looking over your shoulder, as it were, representing for you your sense of accountability to the professional standards of your community. A child doing homework, a doctor making a decision, a traveler reading a book – all these activities implicitly involve other people who may not be present." (Wenger, 1998, p. 57)

The quotation above illustrates the complexity of studying high-level conceptions of online learner participation. It implies that participation is not tantamount to talking or writing. From this perspective, it is not enough to measure how much learners are writing or talking. Below I propose a definition of online learner participation, which takes better account of the more complex dimensions of online learner participation.

5.1. Limitations and further research

It needs to be recognized that the identified conceptions and research approaches were based on 36 out of many publications and do not necessarily reflect research on online learner participation in general but, nevertheless, gives an indication of current practices of research. The literature review of this study should only be considered as a subset of research on online learner participation since some publications may be published in other formats such as in books and conference proceedings. The classification of conceptions could have been compiled in other ways, which indicates that further research can further develop these conceptions and suggest alternative categories. For example, none of the studies conceptualised participation as perceived writing and reading, which would have led to introducing another level.

The literature review presented in this paper had quite a narrow focus and only included research that explicitly focused on online learner participation. In doing this, research that use other terms, such as computer-mediated communication, online community and collaboration, web 2.0 and online social networks, was not included. Consequently, the literature review presented here should be regarded as an attempt to open a window on to the community that research online learning participation, rather than providing a complete overview. The sample should not be regarded as anything other than small given the wealth of literature in this area.

5.2. Online learner participation: a definition

By drawing on the review of this paper, and especially the work of Wenger (1998) and, Vonderwell and Zachariah (2005), I suggest the following definition of online learner participation: *Online learner participation is a process of learning by taking part and maintaining relations with others. It is a complex process comprising doing, communicating, thinking, feeling and belonging, which occurs both online and offline.* This definition emphasizes that students learn both online, e.g., by computer-mediated communication with peers and teachers, and offline, e.g., by reading course literature. It moves beyond conceptualising participation as writing by including terms such as doing and belonging. As web 2.0 continues to evolve, other types of online learner participation such as audio and video communication will surely become more commonly used in e-learning settings. Hopefully, the suggested definition is useful for such emerging applications since it does not focus on text-based communication.

6. Conclusion

This paper has examined the conceptions and research approaches that underlie research on online participation in e-learning settings. A classification scheme was iteratively developed and used when publications on the topic were reviewed. It was found that research is dominated by low-level conceptions of online participation, which relies on frequency counts as measures of participation. However, some researchers aim to study more complex dimensions of participation, such as whether participants feel they are taking part and are engaged in dialogues, reflected by using a combination of perceived and actual measures of participation. By drawing on the review of this paper, I proposed the following definition of online learner participation that acknowledges its more complex dimensions: *Online learner participation is a process of learning by taking part and maintaining relations with others. It is a complex process comprising doing, communicating, thinking, feeling and belonging, which occurs both online and offline.*

Appendix A. Classification of articles

Source	Level	Asynchronous communication	Synchronous communication	Quantitative method	Qualitative method	Messages/ units	Message quality	Learner perceptions	Message length	Accesses/ logins	Read messages	Time spent
Ross (1996)	3	√		√	√		√		√			
Ruberg et al. (1996)	6	√			√			√				
Bullen (1998)	5	√		√	√	√	√	√				
Mikulecky (1998)	3	√			√		√					
Ross (1998)	3	√		√	√	√	√		√			
Arbaugh (2000)	2	√		√		√						
McLean and Morrison (2000)	2	√		√		√						
Poole (2000)	4	√		√	√	√	√		√	√	√	
Davidson-Shivers et al. (2001)	3	√	√	√	√	√	√					
Woods and Keeler (2001)	2	√		√		√			√			
Jung, Choi, Lim, and Leem (2002)	2	√		√		√						
Lipponen et al. (2002)	3	√		√	√	√	√					
Lobel, Swedburg, and Neubauer (2002)	2		√	√		√						
Williams and Pury (2002)	6	√		√	√	√	√	√			√	
Woods (2002)	2	√		√		√						
Böhlke (2003)	2		√	√		√						
Ellis (2003)	6	√		√	√	√		√		√		
Hakkarainen and Palonen (2003)	3	√		√	√	√	√					
Lipponen et al. (2003)	3	√		√	√	√	√					
Mazzolini and Maddison (2003)	2	√		√		√						
Carr et al. (2004)	6		√	√	√	√	√	√				

Kuboni and Martin (2004)	6	√		√	√			√		√		√
Masters and Oberprieler (2004)	4	√		√		√			√		√	
Davies and Graff (2005)	1	√		√						√		
Dennen (2005)	3	√		√	√	√	√					
Khan (2005)	6	√		√	√	√	√	√				
Moore and Marra (2005)	6	√		√	√	√		√				
Vonderwell and Zachariah (2005)	6	√		√	√	√	√	√				
Dahlgren, Larsson, and Walters (2006)	6	√		√	√	√	√	√				
Hrastinski (2006)	6	√	√	√	√			√				√
Jeong (2006)	5	√		√		√	√	√				
McLinden et al. (2006)	6	√	√	√	√			√				√
Janssen et al. (2007)	3		√	√	√	√	√		√			
Olofsson (2007)	6	√	√		√			√				
Prinsen et al. (2007)	2	√		√		√			√			
Caspi et al. (2008)	2	√		√		√				√		

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