Allocation of Tertiary Students for Group Work: Methods and Consequences

ABSTRACT

Graduate Quality by most Australian universities. While the benefits of group work are well noted, for some academics, a dilemma exists about methods used to allocate students to groups and the rationales for doing so.

This article reports on a review of current literature to describe the different methods available for group selection, the pedagogical rationales which underpin those selection strategies and the associated teaching and learning outcomes. The major group selection processes identified in the literature include student selection, academic selection, random selection and mixed pair selection. Eleven studies were identified which directly compared two group selection methods in face-to-face teaching at tertiary institutions from electronic databases.

Outcomes examined included student satisfaction, academic and affective outcomes and students' preference for future groupings. The overwhelming finding was that randomly selected groups did not have favourable learning outcomes compared to any other group selection process. Student selected groups had improved student satisfaction and most favourable learning outcomes.

These findings will inform academic's teaching decisions related to the best group selection process for achieving their intended learning outcomes.

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Introduction

Group work, where students work collaboratively or cooperatively on a learning task, is recognised as providing important teaching and learning opportunities in tertiary education (Bourner, Hughes, & Bourner, 2001; Mello, 1993; Strauss & U, 2007). In its most successful forms, group work develops social and interpersonal communication skills, promotes peer learning and support, and fosters deep learning rather than surface learning.

All these skills are considered critical in professional work and highly valued by future employees (Alsop, 2004; Boud, Cohen, & Sampson, 1999; Gatfield, 1999; Lejk & Wyvill, 1997). For the academic, group work enables learning activities that may otherwise be difficult to achieve (Boud, et al., 1999; Gatfield, 1999; Lejk & Wyvill, 1997; Topping, 1998), including complex problem-based tasks which would overwhelm individual students and tasks which promote the development of collaborative skills. Notably, group work is considered a form of student-centred learning (Lejk & Wyvill, 2001), which has been promoted by the Teaching and Learning Framework of the University of South Australia (Lee, 2007) and embedded into the University of South Australia's Graduate Qualities. Attesting to its importance as of 2008, 23 out of the 38 Australian universities have included group work as one of their Graduate Qualities (University of Sydney, 2011).

Anecdotally, and with support from the literature, there are several practical problems associated with group work, including student dissatisfaction with working in groups and poor performance of groups (Seethamraju & Borman, 2009). Furthermore, academics consider the management of group work demanding, and supporting students to attain the intended learning outcomes difficult (Huxham & Land, 2001). Research suggests that some of these problems may arise due to the way groups are formed and structured (Tu & Lu, 2005). In particular, Strauss and U (2007) highlighted the high levels of frustration and anxiety associated with academics' efforts to structure group work. Academics must determine how to structure and form the groups without supporting evidence on learning outcomes from the literature (Huxham & Land, 2001) and without being fully informed of the dynamics of the student cohort.

While the benefits of group work are compelling, the problems with group work appear to work against the use of group work in tertiary education (Huxham & Land, 2001). Despite the recognition of the value of group work and its associated teaching and learning opportunities, there are no set recommendations for the formation of groups. Therefore, there is a need for evidence-based recommendations, or, at the very least, practical guidelines related to the rationales for selecting students and allocating them to groups. These would be essential to inform academics of a) the range of group selection strategies available, b) the rationales which underpin each strategy and c) the likely outcomes of their group selection process that they employ. The aim of this paper is to review current literature to identify the different processes for forming groups in face-to-face teaching, identify the rationales associated with each process and assess which group formation method provides the best affective and cognitive learning outcomes, providing academics with supporting evidence from the literature.

METHOD

A systematic literature search of peer reviewed higher education journals was conducted in the following order using Educational Resources Information Center (ERIC), Summons and Google, in early 2011. The following search terms were used to identify potentially relevant articles: *assigning groups, group selection processes, team selection processes, resource allocation, group formation, group work, grouping strategies* and *team-based learning and team formation*. This broad search produced thousands of results, which were then narrowed by filtering for those from a) higher education settings, b) face-to-face teaching, and c) those published in peer-

reviewed journals. Thirty-five articles were identified once the search–terms had been filtered. Reference lists and citations arising from these articles were also examined for relevant articles which identified an additional three articles. These articles were then reviewed to identify those that directly compared two or more of selection methods and that had examined the impact on affective and cognitive outcomes. Eleven articles were identified that compared two or more selection processes. A further two articles were also identified which considered outcomes for only one selection process. These articles were synthesised to identify a) group selection strategies, b) identify the rationales (practical or pedagogical) associated with each selection strategy and c) understand the outcomes of different group selection processes, particularly outcomes demonstrated by research. Ultimately, the intention was to support teaching practice by identifying a basis for choosing one group selection strategy over another, in context.

RESULTS

The group selection processes that have been identified from this review can be classified into four types. The selection processes that are available to the academic are *random selection (RS), student self-selection (SS), academic selection (AS)* and *mixed pair selection (MPS)*.

Random Selection

RSinvolves students being randomly (or arbitrarily) assigned into groups with no consideration of criteria sets; that is, students have an equal chance of being placed in a particular group. While this method has been argued to give the impression of fairness (Strauss, U, & Young, 2011), some researchers are critical of random selection stating that it is "not far off from a game of roulette in casting players onto winning or losing teams" (Bacon, Stewart, & Anderson, 2001) (p. 9). In RS groups, there are no apparent rationales for the allocation of students to groups.

Notably, there are variations of RS group selection in which the randomness of selection is limited according to one or two variables such as location (e.g. co-located student must be in the same group), experience (students are randomly allocated within professional or educational experience groupings) or interest (as with random selection within pools of students who have nominated one of several topics as their preference) (Bacon, Stewart & Anderson, 2001; Beheshtian-Ardekani & Mahmood, 1986). These quasi-random selection processes foreshadow group selection processes which are driven by clearer rationales for group allocation, whether the rationales are pragmatic (as in the case of location-based criteria) or pedagogical (as with ability or motivation related criteria) as part of academic-selected groups (below).

Student Selection

SS involves students self-selecting into given grouping structures. From the point of view of teaching staff, this approach seems to lack a clear rationale for group student choices and so may appear to be random. However, when students are allowed to form their own groups they do so with intentionality and a range of rationales for choosing to work with particular other students in particular groupings. Indeed, it has been argued that students may be in a better position to engineer groups than academics, as they may have greater knowledge and insight into their colleagues' skills and attributes than the academics (Huxham & Land, 2001). In this scenario, students often select colleagues with similar abilities and motivation levels, and invariably students who have a track record of higher performance attain better than average grades in the group work and likewise poorer performing students attain lower ones (Bacon, et al., 2001). Bacon et al (2001) go on to state that this outcome has "…a ring of fairness to it." (p. 10).

Academic Selection

In AS groups, the academic applies a set of abilities or criteria to the formation of groups. The criteria used for group formation can be associated with a rationale for not only choosing academic group selection processes, but also the basis for such selections. The rationale may be tacit or explicit and may be based on practical considerations (e.g. grouping students according to session times), pedagogical considerations (e.g. groupings based on complementary skill sets) or combinations of factors. For example, the importance of having complementary skills within a group to maximise the success of the project have been widely argued (Kelly, 2008; Muller, 1989). As such, academics select groups based on different abilities/criteria to either achieve similar abilities/criteri to achieve a balance between strengths and weaknesses in balanced groups. This selection process may be facilitated with learning style questionnaires (Huxham & Land, 2001), academic background questionnaires (Beheshtian-Ardekani & Mahmood, 1986) or algorithms generated by computers (Bacon, et al., 2001). This process requires the academic to decide on the criteria to be used, for example, learning styles, academic performance, age, gender, life experiences, cultural backgrounds, skills and knowledge sets.

Mixed Pair Selection

The MPS model proposed by Mahenthiran and Rouse allows students to self-select pairs, and then the academic randomly places 2 or 3 groups of pairs together to form groups (Mahenthiran & Rouse, 2000); alternatively, the pairs can be combined by the academic to form semi-balanced groups. The authors hypothesize that this may provide the combined advantages of RS and SS groups, encouraging students to discover that anyone in their class can contribute to their learning, and allowing students to select someone that they feel compatible with and thereby giving them some control in the process.

COMPARING THE OUTCOMES OF GROUP SELECTION PROCESSES

Table 1 presents a summary of eleven quantitative and semi-quantitative studies that directly compared the use of two or more different group selection processes and the effect they had on learning outcomes (presented in full in Appendix A). Only one study compared three different group selection methods (Strauss, et al., 2011). In these studies, students were either asked retrospectively about their experiences in group work in the past or they were followed prospectively. Furthermore, students had been assigned to one of two groups using either RS, AS, SS groups or MPS.

Learning outcomes measured included affective outcomes such as intrinsic motivation, satisfaction with group work (Mahenthiran & Rouse, 2000; Muller, 1989), satisfaction with overall performance (Connerley & Mael, 2001), group/team experience (Bacon, Stewart, & Silver, 1999), learning experience (Muller, 1989), attitude measures (K. Chapman, Meuter, Toy, & Wright, 2006), and preference for future group selection methods (Huxham & Land, 2001; Strauss, et al., 2011) as well as academic outcomes such as group grades (Borges, Dias, & Cunha, 2009; Mahenthiran & Rouse, 2000). All the studies used different outcome measures and hence no direct comparison could be made between the studies.

Four studies compared AS groups to SS groups (Borges, et al., 2009; Bosco, Jervis, & Harvey, 2009; Ciani, Summers, Easter, & Sheldon, 2008; Connerley & Mael, 2001). Two studies compared AS groups to RS groups (Huxham & Land, 2001; Muller, 1989). Two studies compared SS groups to RS groups (Bacon, et al., 1999; K. Chapman, et al., 2006). One study compared the MPS groups with RS (Mahenthiran & Rouse, 2000) and another compared the MPS groups with SS groups (Cronholm & Melin, 2006). One study compared SS, RS and AS groups (Strauss, et al., 2011). The criteria used for AS groups were varied, including prior grades (Muller, 1989), the Honey-Mumford method (Huxham & Land, 2001) and considering eight different characteristics of the students (Borges, et al., 2009). In the AS groups, the academics had ensured that they had identified personal and/or academic characteristics of the students that they considered important, this allowed the formation of balanced groups with a maximum diversity of skills.

The consistent finding from all of these studies was that RS groups did not outperform groups formed by any other selection processes. None of the papers that examined RS groups reported better outcomes compared to the other selection methods (Bacon, et al., 1999; K. Chapman, et al., 2006; Mahenthiran & Rouse, 2000; Muller, 1989). Two studies reported no difference found between RS groups and AS groups (Huxham & Land, 2001) or between RS groups and MPS groups (Cronholm & Melin, 2006).

Five out of the six studies reported that SS groups had better outcomes than either AS groups (Bosco, et al., 2009; Ciani, et al., 2008; Connerley & Mael, 2001) or RS groups (Bacon, et al., 2001; K. Chapman, et al., 2006).

Two out of six studies observed that AS groups had better outcomes than RS groups (Muller, 1989) and SS groups (Borges, et al., 2009).

Eight out of the eleven studies used a quasi-experimental approach to test between groups selections (Borges, et al., 2009; Bosco, et al., 2009; K. Chapman, et al., 2006; Cronholm & Melin, 2006; Huxham & Land, 2001; Mahenthiran & Rouse, 2000; Muller, 1989; Strauss, et al., 2011). In these studies students were assigned to groups by the authors and then surveyed directly about their group experiences. The other three studies (Bacon, et al., 1999; Ciani, et al., 2008; Connerley & Mael, 2001) had asked students about prior experiences with group work within their degree programs. Notably, the quality of this evidence may be diminished, as the students needed to rely more heavily on their memory and particularly as interaction with students after the group work could impact on their assessment of the interactions during the group work.

Two studies (Borges, et al., 2009; Cronholm & Melin, 2006) from the nine were SS groups that did not come out favourably where students were involved in group projects designing information systems.

Two studies examined affective outcomes and future preferences for group selection from a single selection process (Kelly, 2008; Russell, 2010). Kelly

Table 1: Summary results of literature review analysis

Author	Outcomes	Group Selection Methods	Results Favoured
Muller 1989	Affective, satisfaction	AS vs RS	AS
Bacon et al. 1999	Affective, satisfaction	SS vs RS	SS
Mahenthiran and Rouse 2000	Affective, satisfaction, cognitive	MPS vs RS	MPS
Connerley and Mael 2001	Affective	SS vs AS	SS
Huxham and Land 2001	Preference for future groupings	AS vs RS	similar
Chapman et al. 2006	Affective	SS vs RS	SS
Cronholm and Melin 2006	Affective	MPS vs SS	neither
Ciani et al. 2008	Affective	SS vs AS	SS
Borges et al.2009	Affective and cognitive	AS vs SS	AS
Bosco et al. 2009	Affective and cognitive	AS vs SS	SS
Strauss et al. 2011	Preference for future groupings	RS vs AS vs SS	SS

(2008) had the students self-select their groups—at the onset of the study half of the students desired AS groups but at the completion of the study 75% of students changed their views, favouring autonomy and wished to select their own groups. Russell (2010) used AS groups in his study and at the conclusion of the study 60% of the students preferred to choose their own partners. The results from these two studies are consistent with those studies that compared two different group selection processes presented in Table 1 (above).

DISCUSSION

This is the first systematic review of the literature to determine the impact of different group selection methods on students' satisfaction and teaching and learning outcomes. While there have been extensive reviews of student satisfaction on group projects (Barfield, 2003; Bourner, et al., 2001; Garvin et al., 1995; Gatfield, 1999; Struyven, Dochy, & Janssens, 2005), the impact of group selection on student satisfaction has not been considered. The question "which group formation method provides higher levels of student satisafaction and the best affective and cognitive learning outcomes?" has produced clear and definitive findings. This review was able to identify eleven studies which had directly compared two or more group selection processes in face-to-face teaching in tertiary institutions. Nine of these studies were prospective studies in which they had placed the students into groups and then assessed the teaching and learning outcomes, while the other two were retrospective, exploring student experiences after the fact. The studies all varied in regards to the demographics of students, subject areas, number of students in groups and the length of group project. Therefore, making comparisons between studies is difficult; however, the synthesis provided by this review has demonstrated consistent findings from both the semi-quantitative and qualitative studies.

The overwhelming finding from this review is that students do not favour RS, it leads to lower levels of student satisfaction and that it is linked with poorer teaching and learning outcomes. Notably, these findings based on affective outcomes may be linked to the notion of the 'rationales' associated with the group selection processes. According to the research, students prefer to see clear rationales for decision making and the random group allocation process has no apparent rationale. Interestingly, students are more concerned with instructor clarity on why the groups were used in the teaching and learning activities, rather than how they formed the groups (Hillyard, Gillespie, & Littig, 2010).

This review has demonstrated that SS groups are highly favoured by students, with better affective and cognitive outcomes, improved satisfaction with group work and students' preferred allocation system for future group projects. Only two studies did not report favourable outcomes for SS groups in this review—compared to MPS (Cronholm & Melin, 2006) and AS

(Borges, et al., 2009)—and these were the only two studies in this review in which the group task was to develop an information system. Whether the group project task influences the group process is another interesting question, which deserves further attention.

Only two studies reported favourable benefits for AS groups—one was the aforementioned study of (Borges, et al., 2009) which had an information systems project, and the other was compared against an RS group (Muller, 1989). Despite these findings, AS groups have seemingly been favoured by academics, as it is believed that the academic has some understanding of the students as well as the needs of the project, and that students may form groups based in friendship. However one study (Seethamraju & Borman, 2009) demonstrated that students did consider the skills and knowledge of fellow students when forming groups. This study was conducted with postgraduate students who are generally more self-directed compared to undergraduate students. Furthermore, this study was conducted in a large class (n=141) where it is more difficult for academics to know their students, in contrast to smaller teaching groups where academics may have a better understanding of student skill sets and knowledge than other students. Additionally, academic staff may have a more complete global understanding of the attributes that are required for the group work.

The other advantage of AS groups as seen by academics is the ability to balance the groups, yet in a study when the learning styles of the students were assessed in an objective manner with the use of the Honey and Mumford learning style questionnaire (Huxham & Land, 2001) it was believed that a good balance (or spread) of different learning styles would be achieved in the groups. The "performance" of this balanced group (AS) was compared to an RS group in two respects—grade obtained and student evaluation of the group work—and neither of these measures were able to demonstrate any differences between the two methods of group selection that were used in this setting. Additionally, there is evidence indicating that academics may misconceive which group formation process students prefer (K. J. Chapman, Meuter, Toy, & Wright, 2010). This study indicated that 52% of students preferred RS groups and the remaining 48% of students preferred SS groups. In sharp contrast, 96% of the academics surveyed believed that the students preferred SS groups; furthermore, the academics had more negative perceptions about the group work experience than the students did. The authors argue that the misled pessimism that the academics feel towards group assignments may lessen their inclination to incorporate it as a teaching and learning activity into their curriculum.

Two papers considered the impact MPS groups have on teaching and learning outcomes. While one showed similar outcomes compared with SS (Cronholm & Melin, 2006), the other demonstrated favourable outcomes against RS (Mahenthiran & Rouse, 2000). More importantly, this latter study also demonstrated that the presence of a friend in a group significantly improved satisfaction and project grades. While there are only two studies that have evaluated the impact of MPS, this group selection process does exhibit potential benefits as a suitable group selection process, coming out equal to SS, and preferential over RS in this review.

Group cohesiveness is defined by group solidarity and a sense of community and belonging, and is recognised (Kelly, 2008) as an important factor to consider in group selection processes, as students are more likely to communicate with each other and collaborate. Group cohesiveness has been posited as an important contributor to the academic performance outcome of the group (Levine & Moreland, 1990), and as such, groups with poor group cohesiveness that exhibit conflict (leading to interpersonal hostility) also have reduced academic performance outcomes (Applebaum, Shapiro, & Elbaz, 1998). The importance of fostering conditions in which each group member has a therapeutic or learning influence on one another has been highly regarded, as has the importance of student compatibility within groups (Mahenthiran & Rouse, 2000). It can be posited that SS groups allow students to choose members who they know they are able to work with in a cohesiveness and non-disruptive manner. There is limited evidence that MPS may also foster group cohesiveness (Mahenthiran & Rouse, 2000).

CONCLUSIONS/FUTURE DIRECTIONS

Student satisfaction has become increasingly important measure of the quality of teaching and learning in higher education. This review of the literature has presented some evidence that indicates that if academics want improved student satisfaction coupled with improved cognitive and affective outcomes ofgroup work they should adopt SS groups for group work. While this review has demonstrated that MS groups also provide beneficial outcomes, there is limited evidence for this with only two reported studies to date examining the benefits of MS groups. The use of AS groups appears to

be substantiated only if the academic has a logical and clear rationale behind the composition of the group that will assist in the desired outcome from the group work. However this review clearly indicates that the use of RS groups should not be adopted by academics in tertiary settings.

While this review has presented the evidence to date on the group selection processes and the teaching and learning outcomes, it is prudent to note that even the best thought out process for selecting groups may not be able to account for and consider the differing personalities and sociocultural backgrounds of group members; how the personal lives of group members may unfold during group work; the interpersonal dynamics that may evolve in groups; the impact of academic staff; and the inherent complexities of the group process in academia. Huxham and Land (2001) support this by stating that 'the complexities of the group process and of interpersonal relations within a group are likely to mean that any quick and easy 'social engineering' is ineffective." (p. 21).

With the compelling benefits of group work in tertiary education there is a clear requirement for more research in this area to determine the ideal selection process to ensure outstanding teaching and learning outcomes, providing students with the skills they require for their professional careers. Improved study designs—where all group selection processes are directly compared in the one study—will produce high quality evidence. Additionally, minimising variables such as teaching staff, number of prior group projects students have been involved in, and using larger student numbers will also provide better quality evidence to make recommendations for teaching practice. Student Selection has been shown to be the preferred group selection process from this review, but what is also apparent from this review is that while the evidence for Mixed Pair Selection is limited, the promising outcomes indicate that it deserves further research.

Group work is a learning process and requires all programs at tertiary level to provide instruction and guidance as part of the teaching and learning curriculum, preferentially in the early years, especially as most universities have it inscribed in their Graduate Qualities. Thus it is essential that research is also required to determine how to best facilitate teaching the process of group work. This notion is supported by Hillyard and colleagues who argue that successful group work is no longer just limited to the instruction and effort of the academic but requires initiatives that are coordinated and supported both by the university as well as within the departments (Hillyard, et al., 2010). While this question at hand, of "how to best form groups?" was of concern in this review, it is the underlying question that also needs consideration, *"what is the best for the student?"*; and anecdotally it seems this question may not be considered in group selection processes. It appears it is easier to base the decision on what is simplest to implement and potentially what will appease the students. This question leads on to further investigation: *"what does 'best outcome' mean?"*. Are we referring to *academic performance, learning outcomes* or *affective outcomes*? Clearly these outcomes should not be mutually exclusive and if the stated objectives of courses are well composed and align with the teaching and assessment (Ramsden, 2003), it will allow students to demonstrate their learning and to achieve grades reflective of their learning.

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APPENDIX A

Summary of studies examining Student Selected (SS), Randomly Selected (RS) and Academic Selected (AS) groups on affective and/or cognitive outcomes

Author & Origin of Research	Method	Outcome
Muller (1989), Faculty of Business, McMaster University, Ontario, Canada	**Subjects:** 130 final year commerce students from two consecutive years; no other student demographics provided **Group Selection Process:** RS vs AS (AS balanced based on academic preparation score determined by a validated questionnaire (Beheshtian-Ardekani & Mahmood, 1986)) **Group Size:** 5-6 **Group Project Details:** > 4 week project (oral presentation and written component) > Same academic staff involved in teaching **Outcomes:** Student satisfaction measured with 7-point Likert scale questionnaire	> AS groups felt slightly more satisfied with their groups, more challenged and that the workload was shared more evenly than the RS groups > Responses in RS groups were more heterogeneous in their satisfaction and perception of the quality of the learning experience > Weak correlation that the more experienced students in the AS group were less satisfied with their group and felt less challenged (-0.16 and -0.13, respectively).
Bacon, Stewart et al. (1999), Department of Marketing, University of Denver, Denver, USA	**Subjects:** 116 1st and 2nd year students in a MBA degree; median age 26yrs, 44% female and 18% international **Group Selection Process:** not stated **Group Size:** not stated **Group Project Details:** not stated **Outcomes:** Retrospective survey of students' group experiences	> Best team experience more likely to be in a SS group (75%) than a RS group (51%) p=0.001 > Best teams were less likely to be in RS (14%) than worst teams (29%) p=0.011
Mahenthiran and Rouse (2000), College of Business Administration, Butler University, Indiana, USA	**Subjects:** 110 students in an accounting degree **Group Selection Process:** RS vs MPS **Group Size:** 4-6 **Group Project Details:** > 2 week project (oral presentation and written component) **Outcomes:** Group assignment grades & student satisfaction measured with questionnaire	> Satisfaction score with the group project (p=0.025) and project grade (p=0.003) were significantly higher in the MPS compared with the RS > Project Grade was shown to improve in both high and low GPA students > Significant interaction between pairing and Grade Point Average (P=0.012)
Connerley and Mael (2001), Virginia Polytechnic College Institute and State University, Virginia, USA	**Subjects:** 439 undergraduates in management and psychology degrees at 2 universities; average age 20yrs, 59% male **Group Selection Process:** AS and SS **Group Size:** not stated **Group Project Details:** not stated **Outcomes:** Retrospective survey of student satisfaction with group work (average of 5 projects - 50% AS and 50% SS)	> Students who were in SS were significantly more satisfied with the overall performance of the group (P<0.05) compared with AS groups.

Author & Origin of Research	Method	Outcome
Huxham and Land (2001), Napier University, Edinburgh, Scotland, UK	**Subjects:** 243 undergraduate 1st year students in Biological Sciences over 2 consecutive years (1996 & 1997), 66% females **Group Selection Process:** RS vs. AS **Group Size:** 4-5 **Group Project Details:** 6 week project (poster) **Outcomes:** affective & cognitive outcomes, preference for future groupings	> No significant difference in median marks between groups > In 1996, 73% preferred to choose their own groups, with no difference between RS and AS (P=0.48). In 1997, 56% preferred to be assigned to groups, with no difference between RS and AS (P=0.74) > Preference for future groupings was different between 1996 and 1997 – if results are averaged over 2 years 61% preferred to choose own groups, and this finding was not presented in this study) > No significant difference in affective outcomes
Chapman, Meuter et al. (2006) California State University, California, USA	**Subjects:** 583 students in a marketing course; 62% male **Group Selection Process:** RS vs. SS groups **Group Size:** 2-6 **Group Project Details:** 1 semester (data collection & analysis, and written & oral presentation) **Outcomes:** Affective outcomes (33 factors measured)	> 16 outcomes were significantly higher ($p<0.05$) in the SS group > 3 were significantly higher in the RS group ($p<0.05$) > 13 outcomes showed no difference between the groups
Cronholm and Melin (2006) Dept of Computer and Information Science, Linköping University, Linköping, Sweden	**Subjects:** 60 students in first year Information systems course **Group Selection Process:** MP vs. SS groups **Group size:** 6 **Group Project Details:** 15 weeks **Outcomes:** Qualitative analysis of affective outcomes	> Identified strengths in learning outcomes for MP: - Developed understanding of different perspectives; prepared students for working life; improved social skills; students with lower learning ability learned from higher ability students > Identified problems in learning outcomes for MP: - Co-ordination; heterogeneity in knowledge levels, techniques of study, thought process, motivation and personalities leading to obstructed learning by creating a non-creative group climate and ineffective learning.
Borges, Dias et al. (2009) Faculty of Engineering, University of Porto, Portugal	**Subjects:** 706 students in 3 engineering degrees over 3 consecutive years **Group Selection Process:** SS vs. AS (balanced 8 characteristics) **Group size:** 4-5 **Group Project:** not stated **Outcomes:** cognitive outcomes and group work experience	> AS groups had better spread of marks, better final marks and better group-work experience > In SS groups best students grouped themselves together

Author & Origin of Research	Method	Outcome
Ciani, Summers et al. (2008) University of Missouri, Missouri, USA	**Subjects:** 544 1st and 2nd year students (no online courses); 56% male, 87% white **Group Size:** not stated **Group Project:** not stated **Group Selection Process:** AS vs SS **Outcomes:** affective outcomes	AS groups had: > higher (but not significant) level of intrinsic motivation (P=0.06) > higher classroom community perceptions (P=0.04) > more autonomy (P=0.03)
Bosco, Jervis et al. (2009) Roger Williams University, Rhode Island, USA	**Subjects:** 90 students from a Business Policy course; 64% males **Group Size:** not stated **Group Project:** 3 group projects all conducted in one semester **Group Selection Process:** First 2 projects RS, and 3rd SS **Outcomes:** Affective and cognitive	> No significant difference found in GPA. > Student conflicts were higher in the AS groups (P<0.00). Nature of conflicts also differed between 2 groups, with higher percentage of personality, knowledge and workload allocation conflicts in AS groups (P<0.00). > Grades were higher for SS groups (P<0.00). > Qualitative data regarding student team experiences and descriptions of team conflicts supported the empirical data.
Strauss, U et al, (2011) Auckland University of Technology, New Zealand	**Subjects:** 165 students from Applied Humanities and Business; 59% international **Group Size:** not stated **Group project:** not stated **Group Selection Process:** SS, AS, & RS **Outcomes:** Pre and post group work questionnaires of students' group experiences.	Pre-group; 66% preferred SS, 24% preferred AS and 10% preferred RS. Post group: 76% preferred SS, 20% preferred AS and 4% preferred RS.