Streaming of Classes, Social Comparison, and Students' Self-Concept

Olivia Ford

Te Rāngai Ako me te Hauora - College of Education, Health and Human Development, University of Canterbury, New Zealand

Abstract

Whilst there is an abundance of varied research on the benefits and drawbacks of course-by-course streaming, there is agreement in the literature on the value of a student's positive self-concept. This analysis consolidates the findings of a number of primary research papers on the effects of independent course streaming in secondary school mathematics on students' self-concept. Although conclusions vary, the role of social comparison is widely accepted and the subsequent Big Fish Little Pond Effect (BFLPE) and associated contrast and assimilation effects prove to be dominant concepts. To what degree these dictate a student's self-concept is debated but the majority of literature is in support of some degree of contrast effect: that is, a student's academic self-concept is negatively related to the average achievement of their peers. In a streamed context, that puts those most at risk the lower achieving students in all streams.

Introduction

Streaming – and similar practices, also known as ability grouping, setting, or regrouping – refers to the grouping students based on academic achievement in an attempt to create more homogenous groupings (Chmielewski, Dumont, & Trautwein, 2013). Although there is an abundance of research on the perceived benefits and disadvantages of streaming classes, this analysis is written in an effort to consolidate the effects of streaming on student self-concept, with a particular focus on the literature that is based on research in mathematics classrooms. While drawing from a range of research, conclusions and implications will be focused on within-school, course-by-course streaming, where students are streamed in respect to separate subjects independently.

Mathematics is a dominant domain in research on course-by-course ability grouping, perhaps due to it being a more commonly streamed subject (Ireson & Hallam, 2009). In an Australian context, Forgasz (2010) states that mathematics carries authoritative performance connotations and has strong influence on conceptions of achievement, which is similar to the arguments of Bonne and Johnston (2016) and Chui et al. (2008). This

suggests that mathematics, as a subject, may have stronger effects on self-concept.

Academic self-concept can be described as how one perceives his or her capabilities (Chmielewski et al., 2013; Chui et al., 2008). Specifically, mathematics self-concept is referred to "as an individual's belief regarding his or her present capability to solve a given set of mathematics problems" (Bandura, 1986, as cited in Bonne & Johnston, 2016, p. 20). Researchers have alluded to the importance of clarifying concepts of academic self-concept from that of the more global self-concept or self-esteem (Chmielewski et al., 2013; Marsh, 1987).

The research question asked is how, through social comparison and the subsequent effects, does course-by-course streaming of mathematics, affect secondary students' academic self-concepts in the subject and what are the implications for those practising in the education sector, with particular reference to New Zealand education documents.

Review of Literature

Even though positive self-concept in itself is desirable, studies have also shown strong, positive links to motivation, effort, and

subsequent achievement (Marsh, Trautwein, Lüdkte, Köller, & Baumert, 2005; Valentine, DuBois, & Cooper, 2004). Generally, and specifically, in mathematics, findings hold that self-concept can also have longer term effects on outcomes, such as aspirations and course selections (Ireson & Hallam, 2009). This is an interesting and noteworthy link to the claims that streaming in itself can also affect long term outcomes by locking in lower achieving students because future options are likely to be curtailed (Forgasz, 2010).

Supporters of streaming practices (Guill, Lüdtke, & Köller, 2016; Preckle, Göts, & Frenzel, 2010) refer to the benefits of teachers being able to cater to individual student needs, while the contrary argument, including that from New Zealand research, raises the issue of educational inequality (Hornby & Witte, 2014; Macqueen, 2013; Oakes, 1985; Turner, Rubie-Davis, & Webber, 2015). In reference to education in New Zealand, Anthony and Hunter (2017, p. 77) advocate heavily for more flexible, heterogeneous grouping practices with the belief that "over reliance on ability grouping practices are counter to equitable pedagogical practices for diverse learners". These are practices that New Zealand's Ministry of Education are pushing for with documents such as The New Zealand Curriculum (Ministry of Education, 2007) and Tātaiako (Ministry of Education, 2011). They discuss the confusion and conflict that is created when other Ministry of Education initiatives, such as the Numeracy Development Project (NDP) openly support the use of ability grouping (Ministry of Education, 2008).

Social Comparison and Frames of Reference

Researchers agree that a student's academic self-concept is shaped by social comparison (Chmielewski et al., 2013; Chui et al., 2008; Ireson & Hallam, 2009; Liem, Marsh, Martin, McInerney, & Yeung, 2013; Liem, McInerney, & Yeung, 2015). The relative frame of reference used in the research of student self-concept is varied, with older studies primarily using measures of whole school academic achievement (Marsh, 1987; Marsh & Parker, 1984). It is now largely agreed that the frame of reference taken most into consideration by students is the more prominent one, in this case being those in their immediate class or stream environment (Ireson & Hallam, 2009; Liem et al., 2013; Liem et al., 2015). In their studies, Liem and colleagues discuss and investigate what is known as the *local dominance effect* which theorises that, even if it is less representative, people tend to base self-evaluations on the most local frame available (Zell & Alicke, 2010). However, this was only somewhat supported because Zell and Alicke concluded that stream-average achievement was the most salient frame, when class-average achievement should have been the most accurate predictor if strictly following the effect of local dominance. Liem and colleagues' research was justifiably motivated, because prior to their study, support for the local dominance effect was largely based on laboratory evidence with a lack of application to naturalistic school contexts (Liem et al., 2013; Liem et al., 2015). The generalisability of their findings is discussed in following

sections. Chui et al. (2008) also explored a smaller school context in the United States, 170 students from one school, and found that students "most frequently compare themselves with other students who perform similarly to them" in the same stream (p.125).

While specifically investigating frames of reference across English and mathematics, Liem et al. (2015) also raise the notion that students' mathematics self-concepts appear to correspond to their actual proficiency in the subject. This was supported by evidence of achievement in the form of a nation-wide, standardised Primary School Leaving Examination (PSLE) compared to self-concept measured by a self-description questionnaire. They concluded that due to mathematics being a subject with more definite solutions and evaluation standards, students then rely on the task-based criterion standards as a more accurate frame for self-evaluation. This is an interesting factor to contribute towards the research of students' frames of reference in opposition of social comparison.

Contrast vs. Assimilation Effects

The theory on the development of academic self-concept refers to two mechanisms which affect the result of social comparison within ones' frame of reference – contrast and assimilation effects (Marsh, Chessor, Craven, & Roche, 1995). The *contrast effect* refers to a student comparing and contrasting their own achievement with that of their groupings average. If conforming to a contrast effect, the student will have a lower self-concept when those around them have a higher achievement average, and the same student, a high self-concept when the group average achievement is lower (Chmielewski et al., 2013). On the other hand, where upward comparisons make a student feel confident and positive about their own abilities and therefore improve their self-concept, it is the *assimilation effect* at play (Chmielewski et al., 2013; Chui et al., 2008). Therefore the assimilation effect results in students' academic self-concepts being positively affected because they are "basking in the reflected glory" of the members of their high achieving group (Chmielewski et al., 2013, p. 928). There is less consistent evidence for the solidarity of assimilation effect, particularly as the only evidence in reference to streaming refers to upward assimilation, that is, comparison with higher-achieving students raising ones' academic self-concept as described above.

By way of an international comparison of Programme for International Student Assessment (PISA) data, Chmielewski et al. (2013) observed that "students in course-by-course tracking have the highest level of exposure to students in other tracks … and are thus constantly reminded of the relative status of their track". They then concluded from their analysis that when streamed in this way assimilation effects outweigh that of contrast, and students in higher mathematics streams had higher mathematics self-concepts and those in lower streams, lower self-concepts (pg. 932). Ireson and Hallam (2009) reached similar conclusions in their study, conducted across 23 secondary schools in England, a sample that was not included in Chmielewski et al.'s (2013) international comparison.

In comparison, some literature argues and agrees that, when controlling for achievement, the influence of contrast effect outweighs that of assimilation, resulting in what is known as big-fish-little-pond-effect (BFLPE) (Marsh, 1987). This is defined as "equally able students have lower academic self-concepts in high-ability schools than in low-ability schools" (Marsh, 1987, p .280)

Big Fish Little Pond Effect

From their sample of Singaporean students, at a level equivalent to intermediate school in New Zealand, Liem and colleagues found evidence of the BFLPE (Liem et al., 2013; Liem et al., 2015). Their data showed that students in higher mathematics streams did not show more favourable mathematics self-concepts in relation to their peers in lower streams. In their 2013 study, findings indicated that students in the higher stream had lower mathematics self-concepts than those in the lower stream, providing evidence towards a dominating contrast effect. The entirety of their sample, 4,461 Grade 7 – 9 students (age 12-14), were from nine Singaporean schools which reduces the generalisability of their study. However, because all schools followed the same national streaming and assessment policies, they had uniform, comparable measures across every school and stream, which reduced the effect of confounding variables. The education environment in which these studies took place could be described as competitive with emphasis placed on academic success (Liem et al., 2015).

As well as findings about frames of social comparison, Chui et al. (2008) contribute interesting conclusions towards the academic discussion on self-concept. Although they found that higher stream students had higher self-concepts than their lower stream counterparts, which aligns with a dominant assimilation effect, after controlling for grades, stream placement no longer affected students' self-concepts about their mathematics ability. That is, they suggested that in mathematics, a student's grade is the influencing factor on self-concept as opposed to the stream in which they were placed subsequently. With this said, the single American school in which this study took place consistently performed highly in mathematics which suggests for this sample, grades were a significant factor in self-concept. Although also not highly generalisable, this study brings forth valuable future research questions in terms of controlling for grades.

In contrast with the theories of contrast and assimilation, after finding that students tend to compare themselves with those doing better than them, Chui et al. (2008) suggested students do not submit to either of these effects as a form of social comparison. A key conclusion they deduced from their study, which included directionality of student comparison, is that because across-stream comparisons are rare, this should alleviate researchers' concerns that lower stream students have lower self-concepts because they are comparing themselves to higher stream students. Chui et al. (2008) stand by it being other factors that account for this, such as grades, teacher practice, and labels.

Limitations

The use of standardised, one-off testing appears to be a favourable measure of student achievement in studies of streaming and self-concept. For example, the Organisation for Economic Cooperation and Development (OECD)-developed PISA mathematics assessment (Chmielewski et al., 2013), the Maryland School Assessment (MSA) (Chui et al., 2008), GCSE examinations (Ireson & Hallam, 2009) and PSLE (Liem et al., 2013; Liem et al., 2015), many of which were self-reported. As I have already noted this has the potential to allow researchers access to a directly comparable measure across their sample, but using measures, such as high-stake national examinations, could influence a student's association between their own achievement and self-concept. Other researchers have attempted to broaden their use of achievement indicators by using measures such as self-reported Grade Point Average (GPA) (Marsh, 1987) or a Cognitive Abilities Test in correlation with teacher-assigned school mathematics grades (Preckle & Brüll, 2010).

Another recurring reservation raised by multiple researchers, but as yet not addressed, is the complexity of reference groups students use. Such reference groups are known to be "far more complex" than those based simply on class peers or stream achievement (Chmielewski et al., 2013, p. 950). Examples raised are other peer groups, parent influence, previous achievement, teacher influence, and variance in teaching practice between streams (Chui, et al., 2008; Liem et al., 2013; Liem et al., 2015). Although Marsh (1987, p. 804) used achievement measures of the whole school to measure against student self-concept, he recognised that in a high school setting "older students have a broader perspective from which to evaluate their own academic ability" – not just their immediate classmates. He suggested that this would result in a smaller BFLPE but also that it would account for the variance in research results. This, in combination with studies taking place in a multitude of different countries with different streaming policies and practices, could further account for variations in research. It is through efforts such as controlling for grades, as discussed earlier, that researchers are attempting to control these extraneous variables (Chui et al., 2008; Preckle & Brüll, 2010).

It appears there is a balance for researchers to manipulate between sample size, common achievement measures, and uniform grouping practices when constructing samples and methodology. From this information, future research should include those whose aims are to broaden their achievement indications, strive to use actual grades obtained from official records, and investigate how other potential factors (for example teacher interaction or labelling) interact with social comparison and the self-concept of students in different streams.

Implications

Between 2003 and 2012, the self-concepts (self-beliefs) for mathematics of 15-year-old New Zealanders declined (Ministry of Education, 2015). The OECD, an organisation that New Zealand is part of, maintains that the "development and

maintenance of positive academic self-concepts is one of the key objectives of educational systems worldwide" (OECD, 2003, as cited in Liem et al., 2015, p. 104). This illustrates a potential slippage between objective and outcome. Those in support of BFLPE can conclude that those most at risk are the low achievers in all streams (Liem et al., 2015).

There is agreement amongst researchers that there is a need for teachers to downplay the undertaking of social comparison amongst students in the classroom (Chmielewski et al., 2013; Liem et al., 2013). Even if students are constantly reminded of their ability grouping, educators in mathematics can endeavour to promote positive academic self-concepts by focusing on criterion-based assessment, putting less emphasis on competition and developing a supportive classroom environment that appreciates the unique strengths of each individual. In their study based in New Zealand classrooms, Anthony and Hunter (2017) compiled the statements of 102 primary mathematics support teachers and suggested that it is through mixed-ability classes that students can be allowed to listen to and support each other, valuing individual strengths.

Boaler (2013) connects the concept of ability grouping to students' beliefs about potential and mindset. She contends that generally, grouping practices can communicate damaging fixed ability mindsets. It is important that ability is promoted as something that can improve with effort and, specifically in mathematics, that mistakes are opportunities for growth. Bonne and Johnston (2016) connected this idea of mindset and student self-concept to teachers' deliberate use of intervention in the form of pedagogical strategy. Although their study was also conducted in a small number of New Zealand primary schools, students in mathematics classes where teachers made micro-interventions, with the intent of increasing students' mathematics self-concept, such as making student progress explicit, indeed showed an increase in growth mindset belief, academic self-concept, and achievement. Even though Bonne and Johnson (2016) didn't have control over how the intervention was enacted in each case, they stand by the finding that micro-interventions, in the form of pedagogical strategy, resulted in these increases and this perhaps has implications for all teachers.

In their research Anthony and Hunter (2017) found that although New Zealand teachers are being prompted to rethink the largely unquestioned ability grouping practices, there is uncertainty around change. While these observations were only from a select number of primary school teachers, they contributed in a valuable manner that any change in practice to avoid the exclusion and marginalisation of disadvantaged students requires multiple-levels of influence, particularly around streaming. They give examples of professional learning support, exemplars of practice, and whole-school leadership.

Conclusion

This literature review shows some of the connections between independently streamed mathematics classes and students' academic self-concept in the subject. Although research is inconclusive, perhaps due to variations in statistical analysis,

ability grouping practices, sample locations or other confounding variables, the concepts of BFLPE as well as contrast and assimilation effects are dominant. There is agreement in the literature that academic self-concept is shaped through social comparison, but to what extent and the outcomes of such is debated. A common finding amongst the research evaluated in this paper was evidence and extent of BFLPE. That is, a student's academic self-concept is negatively related to the average achievement of their peers. However overall, students in higher mathematics ability streams perhaps show higher academic self-concepts due to there being some accuracy and correlation between said self-concept and their proficiency in the subject. It is suggested that in order to foster positive academic self-concept, teachers' practice should incorporate less emphasis on competition by appreciating the unique strengths of each individual student and their capability to learn.

References

Anthony, G., & Hunter, R. (2017). Grouping practices in New Zealand mathematics classrooms: Where are we at and where should we be? *New Zealand Journal of Education Studies, 52*(1), 73-92. doi.org/10.1007/s40841-016-0054-z

Boaler, J. (2013). Ability and mathematics: The mindset revolution that is reshaping education. *FORUM, 55*(1), 143-152. doi.org/10.2304/forum.2013.55.1.143

Bonne, L., & Johnston, M. (2016). Students' beliefs about themselves as mathematics learners. *Thinking Skills and Creativity, 20*, 17-28. doi.org/10.1016/j.tsc.2016.02.001

Chmielewski, A., Dumont, H., & Trautwein, U. (2013). Tracking effects depend on tracking type: An international comparison of students' mathematics self-concept. *American Educational Research Journal, 50*(5), 925-957. doi.org/ 10.3102/0002831213489843

Chui, D., Beru, Y., Watley, E., Wubu, S., Simson, E., Kessinger, R., . . . Wigfield, A. (2008). Influences of math tracking on seventh-grade students' self-beliefs and social comparison. *The Journal of Educational Research, 102*(2), 125-135. doi.org/ 10.3200/JOER.102.2.125-136

Forgasz, H. (2010). Streaming for mathematics in years 7-10 in Victoria: An issue of equity? *Mathematics Education Research Journal, 22*(1), 57-90. doi.org/ 10.1007/BF03217559

Guill, K., Lüdtke, O., & Köller, O. (2016). Academic tracking is related to gains in students' intelligence over four years: Evidence from a propensity score matching study. *Learning and Instruction, 47*, 43-52. doi.org/10.1016/j.learninstruc.2016.10.001

Hornby, G., & Witte, C. (2014). Ability grouping in New Zealand high schools: Are practices evidence-based? *Preventing School Failure: Alternative Education for Children and Youth, 58*(2), 90-95. doi.org/10.1080/1045988X.2013.782531

Ireson, J., & Hallam, S. (2009). Academic self-concepts in adolescence: Relations with achievement and ability grouping in schools. *Learning and Instruction, 19*(3) 201-213. doi.org/10.1016/j.learninstruc.2008.04.001

Liem, G., Marsh, H., Martin, A., McInerney, D., & Yeung, A. (2013). The big-fish-little-pond effect and a national policy of within-school ability streaming: alternative frames of reference. *American Educational Research Journal, 50*(2), 326-370. doi.org/ 10.3102/0002831212464511

Liem, G., McInerney, D., & Yeung, A. (2015). Academic self-concepts in ability streams: Considering domain specificity and same-stream peers. *The Journal of Experimental Education, 83*(1), 83-109. doi.org/10.1080/00220973.2013.876227

Macqueen, S. (2013). Grouping for inequity. *International Journal of Inclusive Education, 17*(3), 295-309. doi.org/10.1080/13603116.2012.676088

Marsh, H. (1987). The big-fish-little-pond effect on academic self-concept. *Journal of Educational Psychology, 79*(3), 280-295. doi.org/10.1037/0022-0663.79.3.280

Marsh, H., & Parker, J. (1984). Determinants of student self-concept: Is it better to be a relatively large fish in a small pond even if you don't learn to swim as well? *Journal of Personality and Social Psychology, 47*, 213-231. doi.org/ 10.1037/0022-3514.47.1.213

Marsh, H., Chessor, D., Craven, R., & Roche, L. (1995). The effect of gifted and talented programs on academic self-concept: The big fish strikes again. *American Educational Research Journal, 32*(2), 285-319. doi.org/10.3102/00028312032002285

Marsh, H., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2005). Academic self-concept, interest, grades, and standardized test scores: Reciprocal effects of models of causal ordering. *Child Development, 76*(2), 397-416. doi.org/10.1111/j.1467-8624.2005.00853.x

Ministry of Education. (2007). *The New Zealand Curriculum*. Wellington: Learning Media.

Ministry of Education. (2008). *Numeracy professional development projects 2008, Book 3: Getting started.* Wellington: Learning Media.

Ministry of Education. (2011). *Tataiako: Cultural competencies for teachers of Maori learners.* Wellington: Ministry of Education.

Ministry of Education. (2015, May). *Insights for Teachers: New Zealand student self-belief and confidence, and implications for achievement.* Retrieved from Education Counts: https://www.educationcounts.govt.nz/__data/assets/pdf_file/0003/16 5450/Insights-for-Teachers-NZ-Student-self-belief.pdf

Oakes, J. (1985). *Keeping track: How schools structure inequality*. New Haven, CT: Yale University Press.

Preckle, F., & Brüll, M. (2010). The benefit of being a big fish in a big pond: Contrast and assimilation effects on academic self-concept. *Learning and Individual Differences, 20*, 522-531. doi.org/10.1016/j.lindif.2009.12.007

Preckle, F., Götz, T., & Frenzel, A. (2010). Ability grouping of gifted students: Effects on academic self-concept and boredom. *British Journal of Educational Psychology, 80*, 451-472. doi.org/10.1348/000709909X480716

Turner, H., Rubie-Davies, C., & Webber, M. (2015). Teacher expectations, ethnicity and the achievement gap. New Zealand *Journal of Educational Studies, 50*(1), 55-69. doi/org10.1007/s40841-015-0004-1

Valentine, J., DuBois, D., & Cooper, H. (2004). The relation between self-beliefs and academic achievement: A meta-analytic review. *Educational Psychologist, 39*(2), 111-113. doi.org/ 10.1207/s15326985ep3902_3

Zell, E., & Alicke, M. (2010). The local dominance effect in self-evaluation: Evidence and explanations. *Personality and Social Psychology Review, 14*(4), 368-384. doi.org/ 10.1177/1088868310366144