

Research report by the Centre for Arts and Social Transformation, The University of Auckland

# Replanting Creativity during post-normal times

October 2020

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THE UNIVERSITY OF  
**AUCKLAND**  
Te Whare Wānanga o Tāmaki Makaurau  
NEW ZEALAND

**EDUCATION AND  
SOCIAL WORK**  
CENTRE FOR ARTS AND  
SOCIAL TRANSFORMATION

## Replanting Creativity during post-normal times

*Anyone who has known the joy of creating a thing of beauty, however humble, is never quite the same again; the world looks different to him because of what he has created.*

*Gordon was trying to say the unsayable, struggling with thoughts that lay beyond the capacity of mere words to express. Pavlova, when asked what she meant by her interpretation of Swan Lake replied, 'if I had been able to say it in words, do you think I should have gone to all the trouble of dancing it?'*

(Clarence Beeby, Director General of Education, at the funeral of Gordon Tovey in May 1974).

### **Acknowledgements**

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## Executive Summary

This is the first report on The Creative Schools Index research project which seeks to understand students' experiences of creativity in classrooms in New Zealand and Australia. The report is released after decades of neglect of the arts in New Zealand schools. However, the arts were used by thousands of New Zealand teachers as a way to help children return to classroom learning during COVID 19 through the use of the Te Rito Toi, an online site created by the Centre for Arts and Social Transformation. The site includes lessons plans centering around the arts and well-being. Te Rito Toi is the first significant resource for schools to teach in and through the arts and nga toi in over twenty years.

Te Rito Toi has:

- been viewed 300,000 times,
- been used in 114 countries and
- Provided webinars for over 30,000 teachers.

Possibly, more use of the arts and perhaps more importantly, more teaching through the arts, has happened in New Zealand schools over the past few months than in generations. We believe Te Rito Toi has awoken deep interest across all sectors of New Zealand schooling to see a return to the arts as the heart of the curriculum. We recognise a yearning desire for a replanting of the seeds sown by Clarence Beeby, Gordon Tovey, Cliff Whiting, Ralph Hotere, Sandy Adsett, Peter Smith and hundreds of others who over sixty years ago set New Zealand apart from the rest of the world with an arts programme that entrenched creativity within New Zealand schools for generations.

The Creative Schools Index identified and validated eleven multi-layered dimensions that can be understood to constitute a creative learning environment. A measurement tool was constructed to determine norm scores across each of the dimensions as well as calculate a total creativity score for individual schools. Aggregating the individual school's scores has provided a measure of the state of the creative environment within schools in both New Zealand and Australia. This report identifies the state of creativity in New Zealand schools

based on data collected before the explosion of colour and movement brought about by Te Rito Toi.

This report identifies significant issues in relation to creativity within New Zealand schools. The scale and significance of these issues for New Zealand schooling has direct implications for New Zealand's:

- Economic prosperity
- Democratic participation
- Individual and communal well being

Analysis of data collected across 19 schools in the Upper North Island with 1,973 students confirmed long-held concerns that although schools might not necessarily kill creativity they also do not actively encourage or foster environments where students might experience the multiple benefits of creativity.

Our analysis indicates:

- New Zealand schools do not actively foster or encourage creative environments to support student learning.
- Student perceptions of their school's creative environment meaningfully declines across time.
- The frequency of opportunities to be curious declines throughout schooling.
- Children are less likely to take risks with their learning as they get older.
- By the end of secondary schooling the physical environments of schools become less creative.
- Children in schools have little time to be playful with ideas or to engage in imaginative processes.
- Learning increasingly becomes discipline siloed with decreasing opportunities to think and work across knowledge boundaries.
- A correlation exists between student perceptions of creativity, enjoyment and learning.
- There are some meaningful differences between school creative environments.

- There appears to be some meaningful differences between teachers in schools in creative pedagogies impacting on enjoyment and participation levels.
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These findings paint a picture of schooling that speaks beyond metrics of effectiveness and efficiency to other measures of how we might hope our schools to be, of how we might wish our children to spend 13,000 hours of their lives. They remind us of the near death of the arts in New Zealand schools. They reveal how much of our heritage we have casually left behind. This has not happened by accident, but rather by design, by a prioritising of other ends for schooling by government policy intervention.

In his poem, *The Twice Born Seed*, Gordon Tovey asks

*From what sleep*

*Towards what dawn can we sail*

*Our airborne seas?*

The seed he planted so long ago needs to be born again for a new time, for a world and a schooling system in deperate need of healing.

## Are Schools Killing Creativity?

Sir Ken Robinson, in the most popular TEDx talk of all time claimed “If we were to design an education system to kill creativity, we couldn’t design one better than the one we already have” (2006). Robinson argued that global education systems are woefully unprepared to deal with the post-normal times in which we live nor do they help us imagine ourselves out of them. He lamented that although his ideas were enormously popular with individual teachers and principals there wasn’t an education system in the world courageous enough to embrace the joy and wonder of creativity and in particular, the arts.

Sternberg (2003) argued that students can be taught to be creative, but that:

[our] educational system often encourages students to play it safe. On tests they give safe answers. When they write papers they try to second-guess what their professors want to hear. But creative people are always willing to risk something and, in the process, fail some of the time in order to succeed other times. Teachers need to encourage such risk taking. (p.334).

Sternberg’s concerns have been echoed by numerous scholars throughout the following two decades (Ewing, 2010; Harris, 2016; Jefferson & Anderson, 2017; O’Connor, 2013, 2015, 2017, 2019).

In their review of children’s creativity, Kupers, Lehmann-Wermser, McPherson, and van Geert (2019) argue that the voluminous scholarship in this area can be understood through the lens of a complex dynamic systems model of creativity, connecting the multiple levels at which creativity can be measured through the mechanisms of emergence and constraint. Creativity is understood to emerge across a range of time-spans, and incorporates both individual and social dimensions. Using Rhodes’ (1961) seminal model of the ‘4 P’s of creativity’, Kupers et al. categorised theories of creativity according to their focus on either *Person, Product, Process, or Press*. While research on creativity, as a multi-faceted phenomenon, benefits from such theoretical pluralism, investigations of creativity in educational settings are inherently limited if they do not consider the role of social context,

such as interactions between students and teachers. Thus, theories of Press such as Csikszentmihalyi's (1988) system theory or Amabile's (1996) componential theory of creativity emphasise that creativity is socially embedded rather than just occurring in individual minds.

Within the field of creativity research, Kupers et al. (2019) note substantial divergence in scholars' opinions about whether children should be viewed as creative, or if "true" creativity is restricted to adult achievement. Following this model, Kaufman and Beghetto's (2009) 4-C model holds that children's creativity will generally be restricted to "everyday" creativity or problem-solving ("little-c" or "mini-c" creativity), rather than the creativity of highly eminent innovators or artists. Indeed, Csikszentmihalyi (in Sawyer et al., 2003) proposes that if the key role of schools is to transmit culturally important knowledge, then the primary creative function of an educational system will be to lay the foundation for more advanced creative achievements during adulthood. Notwithstanding this role, Csikszentmihalyi argued how

...schools in general could do a much better job to stimulate and nurture "playful and innovative behaviors" in children. Children need playfulness and the opportunity to express themselves in order to become whole persons, to develop self-confidence, and above all, to enjoy their lives. (p.223).

Despite varying perspectives on what children's creativity is, the provision of creative learning experiences is critical.

The results of the Creative School Index project suggest that the cultural and pedagogical environment of New Zealand schools fail to nurture playful, curious and innovative behaviours in children. Schools fail to help children realise their full human capacity through reinforcing environments where creative opportunities are less frequent and almost fade away by the end of compulsory education.



## The Post-normal World

The dearth of creativity across schooling is neither particularly surprising nor, perhaps to many, of great concern. We argue, however, that the particular times in which we live should cause deep and genuine concern over the parlous nature of creativity in school and the wider implications of a system that does not give value to the creative process.

Ziauddin Sardar (2010) argues that the first decades of the twenty-first century have witnessed a series of wake-up calls, of system crises—from security, to climate, to food and water, to energy, to financial markets, and more.

'[W]e have never seen any era when we have been hit by all these multiple crisis at the one time,' says former UN Secretary-General, Ban Ki-moon. 'It is not just that things are going wrong; they are going wrong spectacularly, on a global scale, and in multiple and concurrent ways. We thus find ourselves in a situation that is far from normal; and have entered the domain of the post normal'.



Figure 1: Balmoral School, Year 3 and 4, *The Giant Who Threw Tanstrums*

The term *post-normal* first emerged in 1993 as philosophers of science Silvio Funtowicz and Jerome Ravetz were searching for a way to understand unpredictability and the plurality of perspectives (Funtowicz and Ravetz, 1993). While they do not argue that the post-normal paradigm completely replaces the scientific method, they *do* argue that the normality paradigm is an inadequate starting point for understanding twenty-first-century life. And

yet, our worlds are almost universally predicated on assumptions arising from normality— cause and effect, economic growth, and industrial prosperity. In his paper, *Welcome to Post-normal Times*, Sardar nominates three features of post-normality that are demanding change in our approach to the world: complexity, chaos, and contradictions (2010).

Sardar (2010) says,

complexity, which has as much impact on physics and biology as on ecology, economics, security and international relations, teaches us an important lesson: the notions of control and certainty are becoming obsolete. There is no single model of behaviour, mode of thought, or method that can provide an answer to all our interconnected, complex ills. (p. 52).

Chaos is clearly evident in everything from the knock-on effect of terror attacks to the global financial implications of share-market fluctuations. The third c, contradiction, is “the natural product of numerous antagonistic social and cultural networks jostling for dominance.”(Sardar, 2010, p 439). Nothing perhaps is more contradictory than a booming share market or house prices in the midst of a growing global depression.

At the beginning of this momentous year, we witnessed Australian and New Zealand skies darken with ash from a continent on fire. From one crisis to another, the world order has stumbled under the devastating global impact of COVID-19, resulting in the most serious assault to the economic, public health and social order of the planet in recent history. In 2020, we have truly come to understand that we are living beyond what was once normal and that there is no sense we might ever return to that “normal world”. Constant chaos, contradiction and complexity seemingly dominates news cycles.

Sardar (2010) suggests that the best ways for us to cope with post-normal times

are imagination and creativity. Why? Because we have no other way of dealing with complexity, contradictions and chaos. Imagination is the main tool, indeed I would suggest the only tool, which takes us from simple reasoned analysis to higher synthesis. While imagination is intangible, it creates and shapes our reality; while a

mental tool, it affects our behaviour and expectations. We will have to imagine our way out of the post-normal times. (p, 6).

Creative thinking sits at the heart of hope. Whenever we work creatively—in any aspect of human endeavour—we are engaged in a process of reimagining the world. Because of this, creativity is therefore a tool of political resistance. In fact, creative thinking IS resistance: it insists on the existence of beauty, of imagination, of possibility, beyond an existent order.

This report argues that creative environments should be part of the long term response to the post-normal times in which we live. We now consider the importance of this for the economy, the preservation of democracy and individual and community well-being.

## Implications of lost creativity for economic recovery post COVID-19

Creative citizenship clearly provides an economy with a competitive advantage (Buchanan et al, 2018). Increasingly, New Zealand will require workforces that can not only solve problems but pose new ones, synthesise ideas, take well managed risks to develop ideas, products and services of value. This clearly speaks beyond the contribution that the creative sector makes to the economy, recognising that internationally the trade of creative goods and services has doubled throughout the past twenty years (UNESCO, 2013). As tourism dwindles post-COVID-19 the creative sector both as a domestic market but also in the international trade of film, music, and visual art will become an important part of diversifying the New Zealand economy. More importantly, it will be the competitive edge a creative workforce gives across all sectors of the economy.

Harris argues that “at the forefront of research into creativity in schools is the transferability of creative dispositions and skills, and its impact on improving literacy, numeracy and other ‘core’ skills” (Taddei, 2009 p.27 ). Scholars agree that cognitive flexibility will be the greatest advantage for engaging within a global economy, both critically and creatively.

In 2013, Karl Frey and Michael Osborne headed a team from the University of Oxford that undertook a study called: ‘The future of employment: how susceptible are jobs to computerisation?’ (2013). Their research investigated 702 different occupations to see how technology would change the kinds of jobs we do now. They also examined the workforce impact of technology such as cloud computing, automation and big data mining. They found that 47 per cent of workers in the US are currently at risk. In 2015, a report by the Committee for Economic Development Australia found a similar trend (CEDA, 2015). Critically, jobs that do not require social interaction and that have low levels of creativity are more likely to be displaced by automation (Frey and Osborne, 2013b, p. 44).

Frey and Osborne (2013b) make this finding: ‘For workers to win the race, however, they will have to acquire **creative** and **social skills** [our emphasis]’ (p. 44). Labour market economists in at least two separate research studies find that almost half the jobs that currently exist are likely to be eliminated within a decade or so. By the time a child who is 5

years old in school today turns 16, half of the jobs we are preparing that child for won't be there according to this growing body of research.



Figure 2: Bledisloe School, Year 1 to 6, Teaspoon of Light

COVID-19 has merely accelerated these developments as jobs that existed only nine months ago might never return. Retraining is the urgent and obvious answer, but the longer-term solution is a creative education system that is driven by risk, curiosity and innovation.

It is perhaps time to rethink the idea that the key function of schooling is to prepare students for work. Increasingly we will need young people who can create their own job opportunities and a market that above all else values the imagination. Schooling needs to move from being futures focused to imagining futures. We need to recognise, and urgently, that schools can no longer prepare in post-normal times for the future. The best we can do is ensure young people leave school with the capacities to make and remake their futures often.

Deloitte's (2019) report on the future of work is a direct challenge to schooling systems that remain entrenched in the past:

The future of work is human. This inspiring insight follows Deloitte Access Economics' analysis of changes to the nature of skills in demand since 1988, and extrapolations to 2030. From work of the hands (manual labour), to work of the head (cognitive labour), Deloitte Access Economics has identified an emerging need

for work of the heart (i.e. soft skills such as judgement, resolving conflict and customer service). Indeed, as robotics and artificial intelligence change the nature of work, augmenting both work of the hands and work of the head (e.g. completing excel spreadsheets and making calculations), humans will increasingly need to attend to non-routine work of the head (i.e. generating insights) and work of the heart (i.e. collaborating with diverse teams to make complex decisions). Historically, schools, universities and workplaces have mainly focused on developing and rewarding technical skills (e.g. data analysis). Therefore, the supply for soft skills is being outstripped by the growing demand.

We would argue that ‘the soft skills’ referred to above are inappropriately labelled as they are skills that are hard to learn, hard to practice and increasingly the most tradeable skills for individuals and national economies. There is nothing soft about collaboration, nor of managing human interaction in complex situations. Learning these skills should be routine, commonplace and practised frequently.

These skills, these ways of thinking and working are intrinsic to arts processes. The arts train not just the imagination, but ways of collaborating, of building and making with others. The arts therefore need to be part of the routine of schooling, available to all and valued for their capacity to develop the work of the heart and the brain at the same time. Nothing else in schools can replicate the capacity of the arts to bring the head and the heart together.

## Schooling, Democracy and Creativity

The flowering of creativity in New Zealand schools in the 1950s and 1960s was part of the Progressive movement that swept the world after the calamities of the Great Depression and World War Two. The creation of critically informed creative citizens with a stake in the future of democracy informed much government policy of the First Labour government, including education.

The bedrock of New Zealand schooling for generations were the notions that education is a public good, a national treasure, that acts as a bulwark against extremism - a way for not only lifting individuals out of poverty but also ensuring a flourishing democracy. Beeby and Fraser built the system on the pioneering thinking of John Dewey. Dewey (1916) wrote extensively on the cultivation of the imagination through the visual arts, music and drama. He suggested that education in the arts is not about training children simply in aesthetic appreciation or understanding, but is about creating citizens who hold a belief in the potential of the imagination. Beeby understood too, that this was not just about imagining individual achievement but it was about building the social imagination; a way of nations designing and thinking about possibilities for a more just, equitable and fairer world. He saw creative education, founded in the arts, was the central plank in how schools might not just replicate the social order but be part of changing it.

The great flowering of Beeby's work through the establishment of the Arts and Craft Department was designed with the goal that its impact would last for thirty to forty years. Central to the building of citizenship were Maori arts, spilling from the classroom into the communities. It was genuinely revolutionary in its goals and methods. New Zealand children and their parents were in the business of reimagining New Zealand.

Paolo Freire (1972) shared Dewey's conviction that education provides an opportunity to reimagine one's world. For Freire, agency is achieved through a process of conscientisation, a process of critically reading the world and then transforming or re-writing the world "by means of conscious practical work" (Freire and Macedo 1987 p.35). Building on Freire's model, Peter McLaren (2000) argues that increasingly schools are reduced to preparing students as part of the machine that dehumanises and disempowers young people across

the world. Like Freire, McLaren (2000) offers critical pedagogy as an antidote to education systems that “replicates social inequity and creates an unthinking consumer class” (p. 123).

A truly democratic society requires people who are fully conscious, or fully awake in the world, and Maxine Greene argues it is arts-making which brings the individual into awareness (Greene, 1997). Perhaps it is why some might call art or photography ‘a woke subject.’ Martha Nussbaum (2010) argues the moral imperatives sitting beneath a democratic society are based on the creation of empathetic citizens. She argues that empathetic imagination has been systematically ignored, and severely repressed, by neo-liberal models of education.

Nussbaum (2010) recognises that the increasingly precarious place of the arts in education in Western schooling poses a direct threat to democracy. She contends:

the insatiable drive for increased profit is at the expense of every other indicator of human value and worth; creating people who are less than fully human: If this trend continues, nations all over the world will soon be producing generations of useful machines, rather than complete citizens who can think for themselves, criticize tradition, and understand the significance of another person’s sufferings and achievements. The future of the world’s democracies hangs in the balance. (p. 2).

Nussbaum further argues that alongside the loss of the arts, it is clear that curriculum content has shifted away from material that focuses on engaging and firing the imagination and instead training the critical faculties towards material that is directly relevant to test preparation.

Elliott Eisner (2002) shares this concern, reminding us what is missing from a curriculum: “the options students are not afforded, the perspectives they may never know about, much less be able to use. The concepts and skills that are not part of their intellectual repertoire are part of the null curriculum” (p. 107). Like the formal curriculum, the null curriculum does not occur accidentally but is constructed by policy makers, teacher training institutions, schools and ultimately individual classroom teachers. The collapse of the arts



within New Zealand schools and the attendant issues for democracy can therefore be understood as a result of deliberate government policy intervention.

We argue how the true measure of public education is not in individual achievement, but in the success of participatory democracy. What we risk with the current schooling is creating classes of people disconnected from a sense that they are able to be active participants in their own lives. We believe the dangers of such an approach during post-normal times is obvious as new nationalisms and dehumanising ideologies find fertile ground in collapsing economies.



*Figure 3: Bledisloe School, Year 1 to 6, Teaspoon of Light*

## Creativity, the Arts and Wellbeing<sup>1</sup>

Speaking at the 9th Annual Auckland Theatre Awards in 2017, Prime Minister Jacinda Ardern spoke of how she craved the day:

When we mention the word well-being and we think about the arts; when we mention the word community and we think about the arts. When we mention togetherness, identity, culture, our heritage, and we think about the arts.

Yet still, the arts languish in New Zealand schools. With an increasing desire by government to frame schooling around well-being measures as well as literacy and numeracy scores it is perplexing that the arts, well-being and education remain unconnected in any meaningful way within New Zealand schooling. This next section draws on some of the vast research that sits behind an understanding of what role the arts can play in the well-being of children and young people.

Beyond increasing recognition of the role of creativity in a successful, globalised citizenry, there are many direct and indirect benefits of developing creative skills in and with students. Uptis (2014) discusses how

Fostering creativity in students helps them to develop resilience, resourcefulness, and confidence—preparing them to address life’s challenges. Creativity also carries its own intrinsic value. Developing creative sensibilities and habits enhances quality of life for teachers and students. (p. 2).

Creative explorations enable children to experience situations with no answer, multiple answers, or where “the tension of ambiguity is appreciated as fertile ground, and where

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<sup>1</sup> Much of this section is based on *Creative Practice for Youth Wellbeing in Aotearoa: Mapping the Ecosystem* (2019). The full report can be accessed at <https://creativewellbeingnz.org/>

imagination is honoured over rote knowledge” (Upitis, 2014, p. 2). Much of the research suggests that fostering creativity through the arts empowers children to better learn throughout other subjects and areas of their lives raising both personal competencies and academic success. Syllabuses and curriculum documents over the last decade have increasingly mandated creativity (Jefferson and Anderson, 2017), yet research indicates there has been no discernable or systematic rise in creativity within schools.

Clift and Camic (2016) highlight that the role of the arts in promoting well-being has been understood throughout history and across cultures. Belfiore (2008), suggests that the idea of the arts as having healing qualities has a long history and that it can usefully be understood in two ways. One is the

arts as therapy approach according to which the arts are inherently healing and cathartic, and the art in therapy approach according to which artistic creation is one of the tools clinicians have at their disposal for the purposes of diagnosis, prognosis, and treatment. (p.197).

Increased interest in the relationship between arts, health and well-being has resulted in the emergence of a distinct field of practice over the last 60 years. The term, arts for health and wellbeing, is now used internationally as an umbrella for a diverse, interdisciplinary field of activity which draws from arts, health, psychology, education, community and youth development practices and theories. Growth of the field has been so rapid that when charting the rise of arts in community health practice in the UK, Mike White (2016) described the arts for health movement broadly as a “small-scale global phenomenon” (p. 41).



become another label to justify a range of programmes to contain the threat and risk they pose without needing to address the underlying causes of global instability, particularly the growing disparity between rich and poor. (p. 125).

O'Brien and Donelan (2008) suggest that the arts are seen by many as a panacea for social disadvantage, and that critical debate is needed to prevent them from becoming instruments of social control. Cahill's (2008) chapter suggests that 'problem-centric' programmes can unwittingly position participants negatively as bad, or sad, or failing in some way, and this can potentially reinforce negative stereotypes and disempower rather than enable. She suggests it is imperative young people are positioned as solutions not problems to be fixed. Cahill and Coffey's (2016) paper about their work with young people in Asia explores this idea further. The paper highlights powerful ways in which young people are positioned within their work as active agents with the potential to enact the change they want to see, rather than passive recipients of change pre-determined by others. Key to this is the co-creative nature of relationships which often sit at the heart of arts programmes. They suggest that this is the route through which young people are able to reframe life stories and imagine new possibilities.

Hickey-Moody (2013) explores young people's participation in the arts extensively. Hickey-Moody cautions us to develop more critical awareness of the way the arts are used to frame perceptions of young people. She suggests that "the arts are not technologies of social control" but that their value lies in offering "methods through which young people become themselves and express opinion and critique" (p.46). Art-making, Hickey-Moody (2013) suggests "is an act of resistance offering the potential for young people to re-imagine and articulate their place in the world, challenge social norms, and offering a means for us to see them differently" (p. 10).

There is a body of literature that articulates the unique qualities and potential of the creative process in young people's learning and well-being. This research largely emanates from an arts education research context, and offers valuable accounts of the relationship between young people and creativity. Elliot Eisner has written extensively about the affective nature of the creative process and its value within youth learning and wellbeing. In her (2014) essay, *The Foundational Bases of Learning With the Arts*, Shirley Brice-Heath,

highlights multiple cognitive, developmental and social benefits of arts participation. Citing Turner (2006) she states that

Art-making affects memory, language, vision, auditory perception, emotional development, and mental health and wellbeing... it is nearly impossible to box off one or two key skills or cognitive growth areas as unaffected by sustained arts practice. (Brice-Heath, 2014, p. 358).

Further to this, Brice-Heath (2014) joins other voices in emphasising the important contribution arts participation makes in the context of contemporary life. She asserts that

Never before has it seemed more important that young people are equipped to be able to find new ways of thinking and working through uncertainty, or developing personally, and of having the skills to engage and to be responsible for shifting their social contexts. (p. 361).

## The Creative Schools Index Research Project

The Creative Schools Index research (CSI) was established in 2016 with the core aim of investigating the possibility of developing a robust measure of the creative environments of schools. Funding for the project was provided through The University of Auckland's Creative Thinking Project as the result of a significant philanthropic gift by the Chartwell Trust. A team of senior academics and researchers from the Universities of Auckland, Sydney and Monash came together to develop an index using quantitative data to inform government policy on creativity education whilst simultaneously providing support to make schools more creative places.

The goal of the Creative Schools Index is to develop a multidimensional model of student experience of classroom-based creativity through a construct validation approach. The research seeks to make schools places where teachers and students can regularly experience the joy of the creative process by:

- Providing schools with robust reliable data that measures their overall creative environment
- Providing schools with nuanced and detailed data to suggest ways in which classroom pedagogy might shift across eleven dimensions of creativity.
- Providing governments with an overall picture of the creative environment of schools
- Providing advice to governments to understand and measure change caused by different initiatives on the creative environment

### **The initial project team included:**

- Professor Peter O'Connor, The University of Auckland
- Professor Michael Anderson, The University of Sydney
- Associate Professor Kelly Freebody, The University of Sydney
- Associate Professor Paul Ginns, The University of Sydney
- Dr Stephen McTaggart, The University of Auckland
- Associate Professor Anne Harris, Monash University, Melbourne.

Professor Gavin Brown, The University of Auckland provided academic oversight of the quantitative technical report included in this report.

**The international expert advisory committee:**

- Professor Pam Burnard , University of Cambridge
- Associate Professor Julie Dunn, Griffith University
- Professor Robyn Ewing, University of Sydney
- Dr Michael Finneran, University of Limerick
- Professor Penny Hay, Creative Learning Environments – UK
- Dr Mary Ann Hunter, The University of Tasmania
- Professor Andrew Martin, University of New South Wales
- Professor John O’Toole, University of Melbourne
- Professor Jim Tognolini, University of Sydney

We drew upon and adapted Harris’s (2016) research into creative skills and capacities (see Table 2.2, pp.42-3), as well as a measure of environments fostering creativity (see section 3.1 of Davies, Jindal-Snape, Collier, Digby, Hay, & Howe, 2013 for a review of the role of environments in school-based creativity). Eleven dimensions of a creative environment were hypothesised. We applied a construct validation approach using confirmatory factor analysis to an instrument traversing the 11 dimensions in the initial testing of the instrument in New Zealand Primary schools. Fit of a higher order factor model was deemed acceptable, providing evidence of within-construct validity of the instrument. Evidence for between-construct validity of the instrument was provided through substantial correlations of the overall “creative classroom” latent factor with self-reports of classroom participation and school enjoyment.

The dimensions of creativity that informed the development of our research instruments are:

- **Collaboration:** To work in a group of two or more to develop shared understandings and achieve shared goals.



- **Problem solving:** To identify and articulate problems and devise strategies for their solutions and/or management considering consequences and outcomes.
- **Critical thinking:** To investigate the wider social and cultural context of ideas.
- **Playfulness:** To use imagination to create made up worlds and situations. This capacity is often associated with enjoyment and fun.
- **Environments:** The qualities of the environment, including physical, emotional and intellectual, and their adaptability for a diversity of classroom-based activities.
- **Divergent thinking:** To think differently about known problems; to evaluate the knowledge students have from different perspectives and to find new ways of understanding.
- **Innovation:** To realise creative ideas in tangible ways.
- **Discipline knowledge:** To develop expertise in a domain of knowledge that involves specialised content and process understandings.
- **Risk-taking:** To be supported when trialling unconventional or previously unconsidered approaches.
- **Synthesis:** To connect ideas to develop new understandings or approaches.
- **Curiosity:** A desire to explore, examine and understand how things are and how things work.



Figure 5: George St Normal School, Year 1 & 2, My Many Coloured Days

To construct a research instrument, potential survey items for each of the outlined dimensions were developed by the project team. Initially 4-6 items were developed for each dimension and items were then refined through a two-step process. Firstly, an expert review panel was convened involving 10 university scholars with expertise in creativity in education, arts education, or psychometrics. The panel members provided feedback on item wording and the extent to which items fit into the proposed dimension construct. Items were refined after advice from this panel. Secondly, items were tested through cognitive interviewing of 60 Year 6, 7 and 8 students from a school in Auckland. Students were asked to paraphrase items as a test of item comprehensibility and the items were then further revised based on student feedback and success rates for paraphrasing. Following this developmental process, 882 students in 8 schools across Auckland participated in a final validation phase for the instrument. The students were asked to rate each of the 56 questions/statements on a five-point Likert level of agreement scale:

1. Never or only rarely true
2. Sometimes true
3. True of about half of the time
4. Frequently true
5. Always or almost always true

To obtain a class/classes result we calculated the average responses of all students to the 4-7 questions/statements within each creativity dimension. This gave us a set of 11 'scores' on our 1- 5 agreement scale. We calculated scores for the Year 5, 6, 7 and 8 combined. The school score is the average of the combined 11 dimension scores.

Since 2017, The Creative Schools Index has been used in 56 schools across New Zealand and Australia with 16,000 students participating.

The Creative Schools Index has provided schools with valid and reliable data that goes beyond a single creative environment 'score' to provide information on a range of dimensions constituting a creativity-fostering environment. We have provided participating schools with a fine-grained understanding of the extent to which student perceive their learning environment to be 'creative' and have assisted in the design and delivery of more focused, context-specific professional learning.

We anticipate the more wide-scale application of this instrument will allow systems and academic communities to generate a broader picture of the development of environments that foster creativity, and develop understandings for specific demographic (e.g., cultural, indigenous, gender, socio-economic status) groups that may or may not be served well by current school environments.

The Creative Schools Index can provide information on the relationship between creativity and student achievement. The project aims to be scalable at a level where policy arguments can be argued on the interconnectedness of the environment for creativity and achievement in the key areas of literacy and numeracy and student motivation. We understand a statistically reliable index builds on the qualitative research that has recognised the interrelationship for many years and should speak more readily to government education policy makers.

Purposive sampling of the data from New Zealand schools was undertaken in August 2020 to give a wide cross section of schools in the Upper North Island, across decile rankings and a mix of urban and rural schools. Analysis was conducted on the data involving 17 schools and 1,973 students by Anran Zhao, a 4<sup>th</sup> year PhD candidate with extensive experience in data analysis. Professor Gavin Brown directed her work and exercised quality assurance for the technical report included at the end of this report.

### Data analysis

A series of data analyses were performed. Firstly, descriptive statistics were performed to examine the means and standard deviations of the sixteen variables by both Year level and Year and Gender levels. Secondly, Bi-variate correlations were conducted to examine the relationships among CSI variables, validation variables, and composite variables of CSI. Then, multivariate analysis of variance was performed. Models examined are listed below:

- **Model 1:** One-way MANOVA analysis of CSI index (11 variables) by Year
- **Model 2:** One-way MANOVA analysis of validation variables (2 variables) by Year
- **Model 3:** Two-way MANOVA analysis of CSI index (11 variables) by Year and Gender, with full factorial design.
- **Model 4:** Two-way MANOVA analysis of validation variables (2 variables) by Year and Gender, with full factorial design.

Lastly, significant MANOVA results were followed by univariate ANOVA analysis and discriminant analysis in the case of only one independent variable (i.e., Year).

The report indicates significant declines in creative environments from primary to senior secondary schools and suggests that the most meaningful declines are in the dimensions of risk taking, curiosity and physical environment.



*Figure 6: Balmoral School Year 7 & 8, The Green Children*

**In summary the data reveals:**

- New Zealand schools do not actively foster or encourage creative environments to support student learning.
- Student perceptions of their school’s creative environment meaningfully declines across time.
- The frequency of opportunities to be curious declines throughout schooling.
- Children are less likely to take risks with their learning as they get older.
- By the end of secondary schooling the physical environments of schools become less creative.
- Children in schools have little time to be playful with ideas or to engage in imaginative processes.
- Learning increasingly becomes discipline siloed with decreasing opportunities to think and work across knowledge boundaries.

- A correlation exists between student perceptions of creativity, enjoyment and learning.
- There are some meaningful differences between school's creative environments.
- There appears to be some meaningful differences between teachers in schools using creative pedagogies impacting on enjoyment and participation levels.

## Conclusion

The Creative Schools Index project outlines that across all eleven dimensions of the creative environment, the frequency of creative opportunities diminish across the school system. We argue that although Sir Ken Robinson's idea that schools are killing creativity might be overstated, clearly New Zealand schools are not valorising or encouraging creative dispositions, nor are they building skills and knowledge in the creative process. We further argue that in failing to do this we incur several major risks. We fail to optimise potential for economic recovery, we risk damage to democratic institutions and we fail to use the power of the arts for individual and community well-being.

*When he came to the Department of Education, most of the schoolrooms were drab and colourless; when he left they were ablaze with colour, buzzing with activity and alive.*

(Clarence Beeby, May 1974)

It is time now to replant the seed of creativity in schools.



## CSI School Creativity Survey: NZ Norms Analysis

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Quant-DARE Tech. Rep. #2020\_05

Quant-DARE Technical Report prepared for the CSI project led by Prof. Peter O'Connor.

Anran Zhao

*The University of Auckland, Quant-DARE unit*

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## Technical Report

Quant-DARE was supplied with an SPSS data file and asked to create norms across the eleven creativity dimensions. Assumptions on which the following results are based include:

- Because there were relatively small numbers by Year group, students were grouped into senior primary (Years 5-6), intermediate (Years 7-8), junior secondary (Years 9-10), and senior secondary (Years 11-13) cohorts.
- Because of low sample sizes in four of the six ethnic groups, no norms by ethnicity are created.
- Missing values were observed for 14 participants, but listwise deletion was requested.
- Syntax for creation of scale scores was supplied by the client.

Analyses were conducted by Anran Zhao, a 4<sup>th</sup> year PhD candidate with extensive experience in data analysis and who has worked as GTA for Educ 706 *Measurement and Advanced Statistics*. Prof. Gavin Brown has directed her work and exercised quality assurance for this report.

### Variables

There are four sets of variables under examination. a) demographic variables with Gender and students' Year level; b) the average scores for the 11 contributing variables for creative school index ( $k = 11$ ); c) two validation variables designed to validate the Creative Schools Index (i.e., school enjoyment and classroom participation); and d) the overall averaged scores across all Creative Schools Index variables, of which, three versions were created (i.e., csi\_11, csi\_56 and csi\_44).

### Data analysis

A series of data analyses were performed. Firstly, descriptive statistics were performed to examine the means and standard deviations of the sixteen variables by Year level and by Year and Gender levels. Secondly, Bi-variate correlations were conducted to examine the relationships among CSI variables, validation variables, and composite variables of CSI. Then, multivariate analysis of variance was performed. Models examined are listed below:

- **Model 1:** One-way MANOVA analysis of CSI index (11 variables) by Year
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- **Model 3:** Two-way MANOVA analysis of CSI index (11 variables) by Year and Gender, with full factorial design.
- **Model 4:** Two-way MANOVA analysis of validation variables (2 variables) by Year and Gender, with full factorial design.

Lastly, significant MANOVA results were followed by univariate ANOVA analysis and discriminant analysis in the case of only one independent variable (i.e., Year).

## Results

Of the total sample ( $N = 1984$ ), 1973 (99.4%) did not have missing values on the sixteen scores of interest. Cases with at least one missing values were removed from further analysis. Further, the 255 (12.9%) cases that did not report their gender information were also removed wherever the analysis involves gender as an independent variable (i.e., Models 3 and 4).

## Descriptive analysis

Table 1 reports the descriptive statistics of the variables of interest by Year level. The data was univariate normal with absolute values of skewness and kurtosis ranging from 0 to .86 and .02 to .62, respectively. A preliminary examination of the descriptive statistics found a general trend of decrease of endorsement as Year level increases.

**Table 1**

Descriptive statistics by Year ( $N = 1973$ )

	Senior Primary	Intermediate	Junior Secondary	Senior Secondary
<i>CSI index</i>				
Collaboration	3.77 (.69)	3.70 (.71)	3.59 (.77)	3.42 (.83)
Problem Solving	3.79 (.71)	3.66 (.77)	3.52 (.78)	3.19 (.85)
Critical Thinking	3.30 (.76)	3.24 (.77)	3.25 (.77)	3.07 (.79)
Playfulness	3.18 (.85)	2.98 (.91)	2.98 (.88)	2.70 (.82)



	Senior Primary	Intermediate	Junior Secondary	Senior Secondary
Environment	3.76 (.75)	3.54 (.82)	3.16 (.85)	2.69 (.85)
Divergent Thinking	3.63 (.73)	3.49 (.80)	3.36 (.80)	3.02 (.82)
Innovation	3.18 (.82)	3.04 (.79)	3.02 (.80)	2.86 (.80)
Discipline Knowledge	3.90 (.71)	3.74 (.79)	3.79 (.80)	3.45 (.86)
Risk	4.23 (.65)	3.95 (.79)	3.71 (.83)	3.20 (.85)
Synthesis	3.49 (.79)	3.42 (.86)	3.35 (.86)	2.84 (.91)
Curiosity	3.61 (.85)	3.40 (.96)	3.31 (.92)	2.90 (.96)
<i>Validation Variables</i>				
School Enjoyment	4.27 (.88)	3.93 (1.01)	3.73 (1.10)	3.27 (1.10)
Classroom Participation	4.07 (.81)	4.08 (.85)	3.93 (.96)	3.53 (.97)
<i>Composite Scores</i>				
csi_11	3.74 (.59)	3.61 (.64)	3.48 (.69)	3.10 (.77)
csi_56	3.61 (.55)	3.47 (.63)	3.37 (.64)	3.02 (.70)
csi_44	3.62 (.57)	3.47 (.65)	3.37 (.65)	3.03 (.71)
<i>N</i>	543	630	379	421

**Note.**, Values are displayed as *Mean (SD)*.

**Descriptive statistics by Year and Gender levels.** Table 2 reports the descriptive statistics of the variables of interest by year level. Note that 255 cases (12.9%) had missing values on Gender variable and were excluded from the analysis. Additionally, 17 cases reported non-binary gender (i.e., 3 in Senior Primary, 3 in Intermediate, 6 in Junior Secondary, and 5 in Senior Secondary) and were excluded from the analysis because of insufficient sample size per cell. As a result, 1701 cases were retained (272 cases deleted, 13.8%). The missingness on gender is not independent from Year level ( $\chi^2 = 160.35$ ,  $df = 3$ ,  $p < .001$ ). The most missingness on gender was found in Junior Secondary level ( $n = 120$ , 31.7%), and the least missingness on gender was found in Senior Secondary level ( $n = 6$ , 1.4%). Gender missingness in Senior Primary and Intermediate levels were 14.2% ( $n = 77$ ) and 11.0% ( $n = 69$ ), respectively. Please refer to the supplementary figures for a visual representation of the data.

To understand the difference between deleted and retained samples, univariate ANOVA was performed on the composite CSI variable (i.e., *csi\_56*) to examine the effect of missingness of gender on CSI, by students' Year level. Specifically, a random sample was drawn from the Year group, to match the sample size of same Year group with missing values on gender, except for Senior Secondary level because of insufficient sample size ( $n = 6$ ). To illustrate, a random sample of 120 was drawn from the Junior Secondary sample ( $n = 259$ ), and ANOVA was performed to compare the mean *CSI\_56* between groups with and without missing values for gender. For Primary level, the difference was not statistically significant  $F_{(1, 152)} = 1.54, p = .217$ . For Intermediate level, the ANOVA shows significant result with  $F_{(1, 136)} = 10.27, p = .002$ . Cohen's  $d = -.54$  (full gender information sample as reference), corresponding to a medium effect size. For Junior Secondary level, the ANOVA shows significant result with  $F_{(1, 238)} = 4.51, p = .035$ , Cohen's  $d = -.26$  (full gender information sample as reference). These results suggest that the deletion of cases with missing values on gender significantly reduced the mean endorsement of CSI index variables for Intermediate (medium effect size) and Junior Secondary (small effect size) students. Note that this only influences subsequent analyses when gender is an independent predictor. Nonetheless, the lack of gender information will suppress means for the two groups in the middle of the year sequence (i.e., Years 7-8 and 9-10) and effect any evaluation of the change in mean scores. However, given the small numbers involved, we have not provided norms for without gender information.

**Table 2**

Descriptive statistics by Year and Gender ( $N = 1701$ )

	<u>Senior Primary</u>		<u>Intermediate</u>		<u>Junior Secondary</u>		<u>Senior Secondary</u>	
	F	M	F	M	F	M	F	M
<i>CSI index</i>								
Collaboration	3.89 (.68)	3.67 (.65)	3.68 (.70)	3.67 (.72)	3.58 (.80)	3.60 (.76)	3.48 (.85)	3.34 (.79)
Problem	3.85	3.65	3.63	3.60	3.43	3.44	3.23	3.15
Solving	(.70)	(.71)	(.75)	(.79)	(.79)	(.74)	(.89)	(.80)

	<u>Senior Primary</u>		<u>Intermediate</u>		<u>Junior</u>		<u>Senior</u>	
	F	M	F	M	<u>Secondary</u>		<u>Secondary</u>	
	F	M	F	M	F	M	F	M
Critical	3.35	3.23	3.20	3.22	3.15	3.19	3.13	3.00
Thinking	(.74)	(.78)	(.77)	(.76)	(.81)	(.79)	(.81)	(.76)
Playfulness	3.24	3.06	2.98	2.94	2.85	2.99	2.73	2.67
	(.82)	(.86)	(.89)	(1.01)	(.90)	(.80)	(.83)	(.81)
Environment	3.82	3.63	3.53	3.37	3.09	2.85	2.70	2.66
	(.71)	(.73)	(.78)	(.82)	(.88)	(.75)	(.90)	(.80)
Divergent	3.68	3.52	3.45	3.44	3.30	3.37	3.08	2.94
Thinking	(.74)	(.72)	(.81)	(.80)	(.81)	(.86)	(.84)	(.82)
Innovation	3.22	3.11	2.96	3.13	2.99	3.12	2.85	2.87
	(.83)	(.82)	(.76)	(.85)	(.83)	(.72)	(.82)	(.80)
Discipline	3.92	3.79	3.71	3.64	3.78	3.77	3.48	3.41
Knowledge	(.70)	(.72)	(.81)	(.74)	(.83)	(.87)	(.87)	(.87)
Risk	4.27	4.11	3.95	3.79	3.64	3.49	3.23	3.16
	(.61)	(.66)	(.76)	(.86)	(.90)	(.79)	(.88)	(.80)
Synthesis	3.49	3.36	3.31	3.42	3.25	3.32	2.86	2.83
	(.77)	(.79)	(.83)	(.86)	(.91)	(.86)	(.94)	(.88)
Curiosity	3.69	3.47	3.33	3.42	3.26	3.24	2.99	2.82
	(.82)	(.86)	(.95)	(.93)	(.96)	(.93)	(.99)	(.91)
<i>Validation Variables</i>								
School	4.42	4.14	4.04	3.55	3.69	3.50	3.32	3.22
Enjoyment	(.76)	(.95)	(.95)	(1.10)	(1.19)	(1.10)	(1.12)	(1.09)
Classroom	4.12	4.00	4.18	3.84	4.07	3.47	3.50	3.57
Participation	(.83)	(.79)	(.80)	(.90)	(.92)	(1.09)	(1.00)	(.95)
<i>Composite Scores</i>								
csi_11	3.81	3.60	3.58	3.51	3.43	3.43	3.14	3.06
	(.57)	(.59)	(.59)	(.70)	(.73)	(.72)	(.81)	(.74)
csi_56	3.66	3.50	3.44	3.41	3.31	3.31	3.06	2.98
	(.53)	(.56)	(.60)	(.67)	(.69)	(.67)	(.73)	(.67)

	<u>Senior Primary</u>		<u>Intermediate</u>		<u>Junior</u> <u>Secondary</u>		<u>Senior</u> <u>Secondary</u>	
	F	M	F	M	F	M	F	M
csi_44	3.67	3.51	3.43	3.42	3.30	3.31	3.07	2.98
	(.54)	(.58)	(.63)	(.69)	(.70)	(.67)	(.74)	(.68)
<i>N</i>	255	211	390	171	186	73	232	183

**Note.** Values are displayed as *Mean (SD)*.

### Correlation analysis

Bivariate correlation analyses were conducted to examine the relationship among creative classroom index variables, validation variables, and the composite CSI variables (Table 3). All correlations were statistically significant at alpha of .001 level.

All 11 CSI variables are inter-correlated in the range  $.50 < r < .75$  indicating that the scores are sufficiently distinguishable to warrant multivariate analysis of variance. The same variables have much weaker correlations ( $.36 < r < .68$ ) with the two validation variables of school enjoyment and classroom participation. In contrast, the 11 CSI variables were more strongly correlated with the three different composite variables ( $.68 < r < .85$ ).

The three CSI index variables and two validation variables had medium values ( $.50 < r < .65$ ). Understandably, the correlation among the three CSI index scores were all large (i.e.,  $r > .90$ ). The high correlation among the three index composite scores will result in multicollinearity for multivariate analysis of variance. Therefore, subsequent analysis employed only csi\_56 in univariate analysis of variance to examine the differences of composite CSI scores between Year levels, and by Year and Gender levels.

**Table 3**

Correlation relationship among CSI index variables, validation variables, and composite CSI scores

Scale	<u>CSI Index</u>											<u>Validation Variables</u>		<u>Composite CSI scores</u>		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Collaboration	—															
2. Problem Solving	.61	—														
3. Critical Thinking	.56	.65	—													
4. Playfulness	.55	.54	.59	—												
5. Environment	.55	.57	.54	.59	—											
6. Divergent Thinking	.56	.66	.63	.58	.64	—										
7. Innovation	.50	.53	.57	.58	.55	.64	—									
8. Discipline Knowledge	.57	.63	.61	.54	.58	.67	.55	—								
9. Risk	.57	.62	.56	.61	.72	.67	.56	.69	—							
10. Synthesis	.52	.60	.60	.59	.63	.70	.65	.64	.70	—						
11. Curiosity	.54	.59	.59	.63	.65	.67	.64	.65	.74	.75	—					
12. School Enjoyment	<u>.47</u>	<u>.48</u>	<u>.42</u>	<u>.52</u>	<u>.61</u>	<u>.49</u>	<u>.41</u>	<u>.51</u>	<u>.68</u>	<u>.52</u>	<u>.59</u>	—				
13. Classroom Participation	<u>.41</u>	<u>.40</u>	<u>.36</u>	<u>.39</u>	<u>.45</u>	<u>.41</u>	<u>.37</u>	<u>.42</u>	<u>.50</u>	<u>.43</u>	<u>.45</u>	<u>.52</u>	—			
14. csi_11	<u>.70</u>	<u>.76</u>	<u>.68</u>	<u>.69</u>	<u>.73</u>	<u>.77</u>	<u>.70</u>	<u>.74</u>	<u>.81</u>	<u>.79</u>	<u>.78</u>	<u>.63</u>	<u>.51</u>	—		
15. csi_56	<u>.72</u>	<u>.79</u>	<u>.77</u>	<u>.76</u>	<u>.80</u>	<u>.84</u>	<u>.76</u>	<u>.81</u>	<u>.85</u>	<u>.84</u>	<u>.84</u>	<u>.65</u>	<u>.53</u>	<b>.94</b>	—	
16. csi_44	<u>.73</u>	<u>.79</u>	<u>.78</u>	<u>.77</u>	<u>.80</u>	<u>.84</u>	<u>.77</u>	<u>.80</u>	<u>.85</u>	<u>.84</u>	<u>.85</u>	<u>.65</u>	<u>.52</u>	<b>.93</b>	<b>1.00</b>	—

**Note.**, italics block = 11 CSI variables with each other; underline block = 11 CSI variables with validation scores and CSI index scores; bolded block = composite SCI scores with each other.



## MANOVA analysis

Table 4 presents the results from MANOVA of the four models tested. All models were run twice, with and without multivariate outliers. The exclusion of multivariate outliers did not impact models' significance and effect sizes (i.e., change on partial eta squared can be observed only at the third decimal point). Therefore, multivariate outliers were retained for further analyses.

The statistically significant results for MANOVA Models 1 (i.e., CSI variables by year level) and 2 (i.e., validation variables by year level) suggest that there was a significant effect of students' Year level on their endorsement of creative school index variables and the linear combination of their reported school enjoyment and classroom participation. Similarly, results from Models 3 (i.e., CSI variables by year and gender levels) and 4 (i.e., validation variables by year and gender levels) suggest that both the main and interaction effects of students' Year and Gender were significant on CSI index variables and the validation variables, respectively.

**Table 4**

Results from MANOVA of the Models 1 to 4

Model	Outlier	Effect	<i>N</i>	Pillai	<i>F</i>	<i>df</i>	<i>p</i>	partial $\eta^2$	Size of effect
Model 1 (11 CSI by Year)	Y	Year	1973	.354	23.845	33, 5883	<.001	.118	medium
	N <sup>a</sup>	Year	1955	.360	23.938	33, 5802	<.001	.120	medium
Model 2 (2 Valid by Year)	Y	Year	1973	.125	43.775	6, 3938	<.001	.063	small
	N <sup>b</sup>	Year	1966	.126	44.002	6, 3924	<.001	.063	small
Model 3 (11 CSI by Year and Gender)	Y	Year	1701	.376	21.925	33, 5055	<.001	.125	small
		Gender	1701	.026	4.132	11, 1683	<.001	.026	small

Model	Outlier	Effect	N	Pillai	F	df	p	partial $\eta^2$	Size of effect
		Year *	1701	.033	1.724	33,	.006	.011	small
		Gender				5055			
	N <sup>c</sup>	Year	1679	.384	22.167	33,	<.001	.128	small
						4989			
		Gender	1679	.027	4.114	11,	<.001	.027	small
						1661			
		Year *	1679	.033	1.680	33,	.009	.011	small
		Gender				4989			
Model 4	Y	Year	1701	.130	39.200	6,	<.001	.065	small
(2 Valid						3386			
by Year		Gender	1701	.020	16.881	2,	<.001	.020	small
and						1692			
Gender)		Year *	1701	.020	5.656	6,	<.001	.010	small
		Gender				3386			
	N <sup>d</sup>	Year	1695	.130	39.213	6,	<.001	.065	small
						3374			
		Gender	1695	.020	17.527	2,	<.001	.020	small
						1686			
		Year *	1695	.019	5.484	6,	<.001	.010	small
		Gender				3374			

Note. <sup>a</sup>18 outliers; <sup>b</sup>7 outliers; <sup>c</sup>22 outliers; <sup>d</sup>6 outliers.



### Post-MANOVA analysis – Univariate ANOVA

Following the significant results from Models 1 to 4, univariate analysis of variance was conducted (Table 5). To control for comparison wise Type I error, Bonferroni adjustment was employed. Consistent across the models, student Year level demonstrated significant impact on the CSI index variables and the two validation variables. On the other hand, in Model 3 (i.e., 11 CSI variables by Year and Gender), Gender had non-significant main effects on students' endorsement of CSI index variables in nine out of the eleven comparisons; the exceptions were Environment and Risk, both of which had trivial effect sizes. Similarly, the interaction effects of Gender and Year were all statistically non-significant across the Model 3 comparisons. Further, Model 4 (i.e., 2 validation variables by Year and Gender) suggests that all but the interaction effect of Gender and Year had significant impact on the students' school enjoyment and classroom participation. However, only the main effect of Year on school enjoyment was medium on magnitude.

Additionally, univariate ANOVA was performed to compare the composite CSI scores between Year Levels (Model 5), and Year by Gender Levels (Model 6) in order to compliment the results from MANOVA. Consistent with MANOVA results, students' Year level was the only significant predictor of differences on the composite CSI score.

**Table 5**

Results from post-MANOVA analysis

IV	Dependent variable	df	F	p	Partial η <sup>2</sup>	Size of effect
<i>Post Model 1— 11 CSI variables ANOVA by Year<sup>a</sup></i>						
Year	Collaboration	3	20.12	<.001	.030	small
	Problem Solving	3	52.99	<.001	.075	small
	Critical Thinking	3	7.40	<.001	.011	small
	Playfulness	3	24.20	<.001	.036	small
	Environment	3	158.02	<.001	.194	medium
	Divergent Thinking	3	51.15	<.001	.072	small
	Innovation	3	12.40	<.001	.019	small
	Discipline Knowledge	3	26.85	<.001	.039	small
	Risk	3	148.25	<.001	.184	medium
	Synthesis	3	53.61	<.001	.076	small
	Curiosity	3	47.58	<.001	.068	small
<i>Post Model 2 – 2 Validation variables ANOVA by Year<sup>b</sup></i>						
Year	School Enjoyment	3	79.90	<.001	.109	medium
	Classroom Participation	3	39.32	<.001	.057	small
<i>Post Model 3 – 11 CSI variables ANOVA by Year and Gender<sup>a</sup></i>						
Year	Collaboration	3	18.87	<.001	.032	small
	Problem Solving	3	43.04	<.001	.071	small
	Critical Thinking	3	6.23	<.001	.011	small
	Playfulness	3	19.36	<.001	.033	small
	Environment	3	141.18	<.001	.200	medium
	Divergent Thinking	3	43.04	<.001	.071	small
	Innovation	3	10.44	<.001	.018	small
	Discipline Knowledge	3	20.24	<.001	.035	small
	Risk	3	124.54	<.001	.181	medium
	Synthesis	3	40.26	<.001	.067	small
	Curiosity	3	41.17	<.001	.068	small

IV	Dependent variable	df	F	p	Partial η <sup>2</sup>	Size of effect
Gender	Collaboration	1	4.91	.027	.003	trivial
	Problem Solving	1	3.25	.071	.002	trivial
	Critical Thinking	1	1.37	.242	.001	trivial
	Playfulness	1	0.56	.455	.000	trivial
	Environment	1	13.45	.000	.008	trivial
	Divergent Thinking	1	1.70	.193	.001	trivial
	Innovation	1	1.35	.245	.001	trivial
	Discipline Knowledge	1	2.58	.108	.002	trivial
	Risk	1	10.46	.001	.006	trivial
	Synthesis	1	0.00	.955	.000	trivial
	Curiosity	1	2.92	.088	.002	trivial
Year * Gender	Collaboration	3	2.30	.076	.004	trivial
	Problem Solving	3	1.26	.286	.002	trivial
	Critical Thinking	3	1.30	.272	.002	trivial
	Playfulness	3	1.60	.186	.003	trivial
	Environment	3	0.96	.410	.002	trivial
	Divergent Thinking	3	1.56	.197	.003	trivial
	Innovation	3	2.62	.049	.005	trivial
	Discipline Knowledge	3	0.29	.834	.001	trivial
	Risk	3	0.31	.815	.001	trivial
	Synthesis	3	1.78	.150	.003	trivial
	Curiosity	3	2.53	.056	.004	trivial
<i>Post Model 4 – 2 Validation variables ANOVA by Year and Gender<sup>b</sup></i>						
Year	School Enjoyment	3	73.90	<.001	.116	medium
	Classroom Participation	3	31.34	<.001	.053	small
Gender	School Enjoyment	1	23.86	<.001	.014	small
	Classroom Participation	1	26.58	<.001	.015	small
Year * Gender	School Enjoyment	3	2.99	.030	.005	trivial
	Classroom Participation	3	8.09	<.001	.014	small

IV	Dependent variable	df	F	p	Partial $\eta^2$	Size of effect
<i>Model 5 – CSI 56 by Year</i>						
Year	CSI_56	3	74.95	<.001	.102	medium
<i>Model 6 – CSI 56 by Year and Gender</i>						
Year	CSI_56	3	60.54	<.001	.097	medium
Gender	CSI_56	1	3.70	.055	.002	trivial
Year * Gender	CSI_56	3	1.21	.303	.002	trivial

**Note.**, <sup>a</sup>alpha level of .05 / 11 = .004; <sup>b</sup>alpha level of .05 / 2 = .025

The series of ANOVA analyses suggest that students differ on the Creative Schools Index with school enjoyment and classroom participation by Year levels, but not by Gender. Post-hoc comparisons were then conducted for Models 1 and 2 by Year level (Table 6). Effect sizes (Cohen's *d*) were also reported on a pair-wise basis. Consistently, the largest effect sizes can be observed between students in Primary level and Senior Secondary level, followed by the differences between students in Intermediate and Senior Secondary levels. Though 10 out of the 14 comparisons between Primary and Intermediate levels were statistically significant, the effect sizes of the differences were all trivial to small. Moreover, only three out of the 14 comparisons between Intermediate and Junior Secondary school levels were statistically significant, and the effect sizes were all trivial to small in magnitude. The differences between Junior and Senior Secondary school students were all statistically significant, however, only four out of the 14 effect sizes were medium while the rest were all small.

**Table 6**

Statistically significant Cohen's *d* values for Models 1 and 2, by Year level

	Reference					
	I Primary Y5-6			II Intermediate Y7-8		III Junior HS Y9-10
	II	III	IV	III	IV	IV
<i>Model 1 – 11 CSI</i>						
Collaboration		-.25	-.47		-.37	-.21

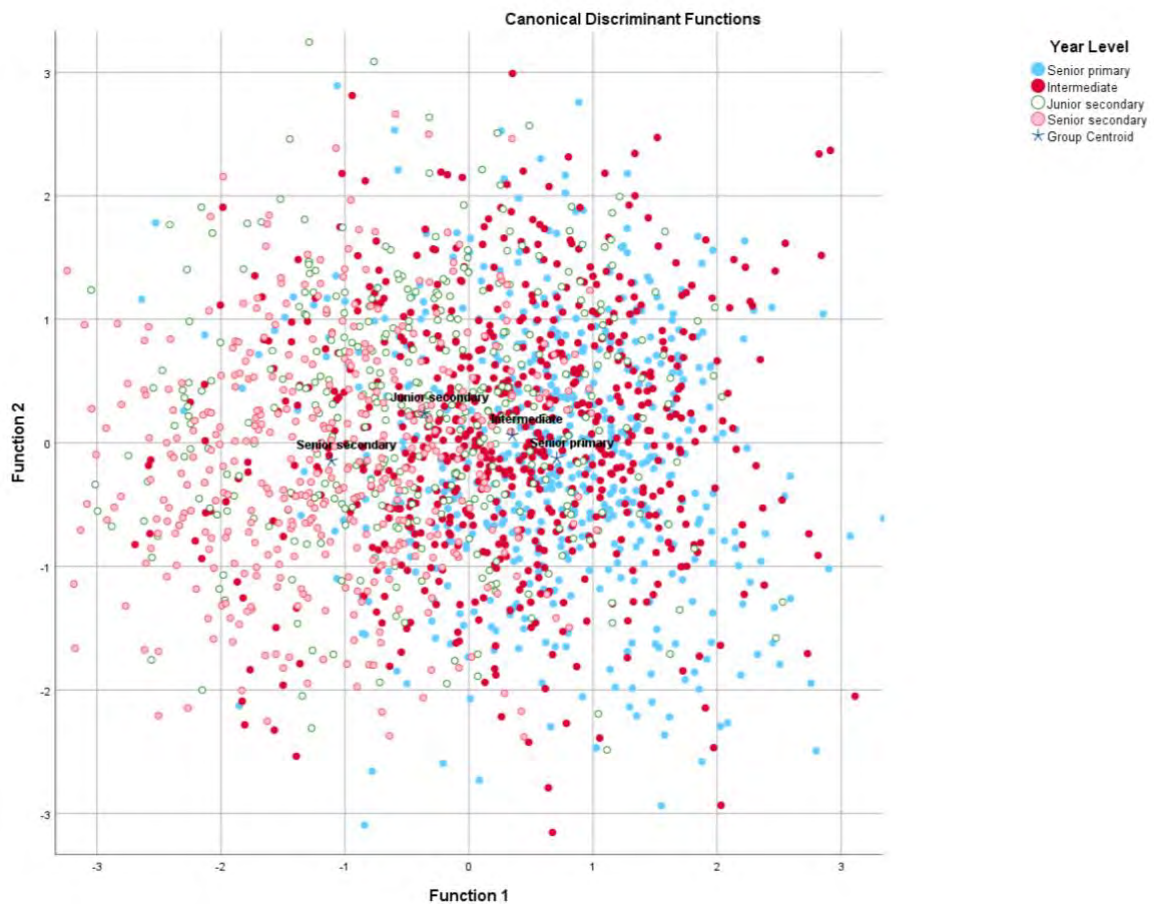
Problem Solving	-.18	-.37	-.78		-.59	-.41
Critical Thinking			-.30		-.22	-.23
Playfulness	-.23	-.23	-.57		-.32	-.33
Environment	-.28	-.76	<b>-1.35</b>	-.46	<b>-1.02</b>	-.55
Divergent Thinking	-.18	-.36	-.79		-.58	-.42
Innovation	-.17	-.20	-.39		-.23	-.20
Discipline Knowledge	-.21		-.58		-.35	-.41
Risk	-.39	-.71	<b>-1.39</b>	-.30	<b>-.92</b>	-.61
Synthesis			-.77		-.66	-.58
Curiosity	-.23	-.34	-.79		-.52	-.44
<b>Model 2 – 2 Validation</b>						
School enjoyment	-.36	-.55	<b>-1.02</b>	-.19	-.63	-.42
Classroom Participation			-.61		-.61	-.41
<b>Model 5 – CSI_56 score</b>						
CSI_56	-.24	-.41	<b>-.95</b>		-.69	-.52

**Note.** Values in bold = Cohen's  $d > .80$  (large effect size); Values in italics = Cohen's  $d$  between .50 and .80 (medium effect size).

### Discriminant analysis

The MANOVA Model 1 is followed up with discriminant analysis. The analysis revealed three discriminant functions. The first explained 92.5% of the variance, canonical  $R^2 = .317$ , whereas the second and the third explained only 4.2%, canonical  $R^2 = .020$  and 3.3%, canonical  $R^2 = .016$ , respectively. The three functions significantly differentiated students' Year groups,  $\Lambda = .658$ ,  $\chi^2(33) = 822.3$ ,  $p < .001$ . The discriminant function plot (Figure 1) showed that the red and blue solid circles for Senior Primary and Intermediate groups are mostly located to the right the plot, whereas pink and white circles for Junior Secondary and Senior Secondary are mostly located to the left of the central axis. However, the distinction between these four groups is not robust. Indeed, only 46.5% of group membership was correctly recovered. This suggests that in terms of Creative Schools Index variables, students differed mostly between the Secondary and Pre-secondary levels.

To further test the differences between Pre-secondary and Secondary levels on the linear combination of the CSI index variables, a second discriminant analysis was conducted pre-secondary vs. secondary levels being the grouping categories. One function was discovered which explained 100% of the variance, canonical  $R^2 = .268$ ,  $\Lambda = .732$ ,  $\chi^2_{(11)} = 613.8$ ,  $p < .001$ . The discriminant analysis correctly recovered the group membership 74.7% of time.



**Technical Report Figure 1.** Discriminant function plot for Post MANOVA analysis, Model 1.

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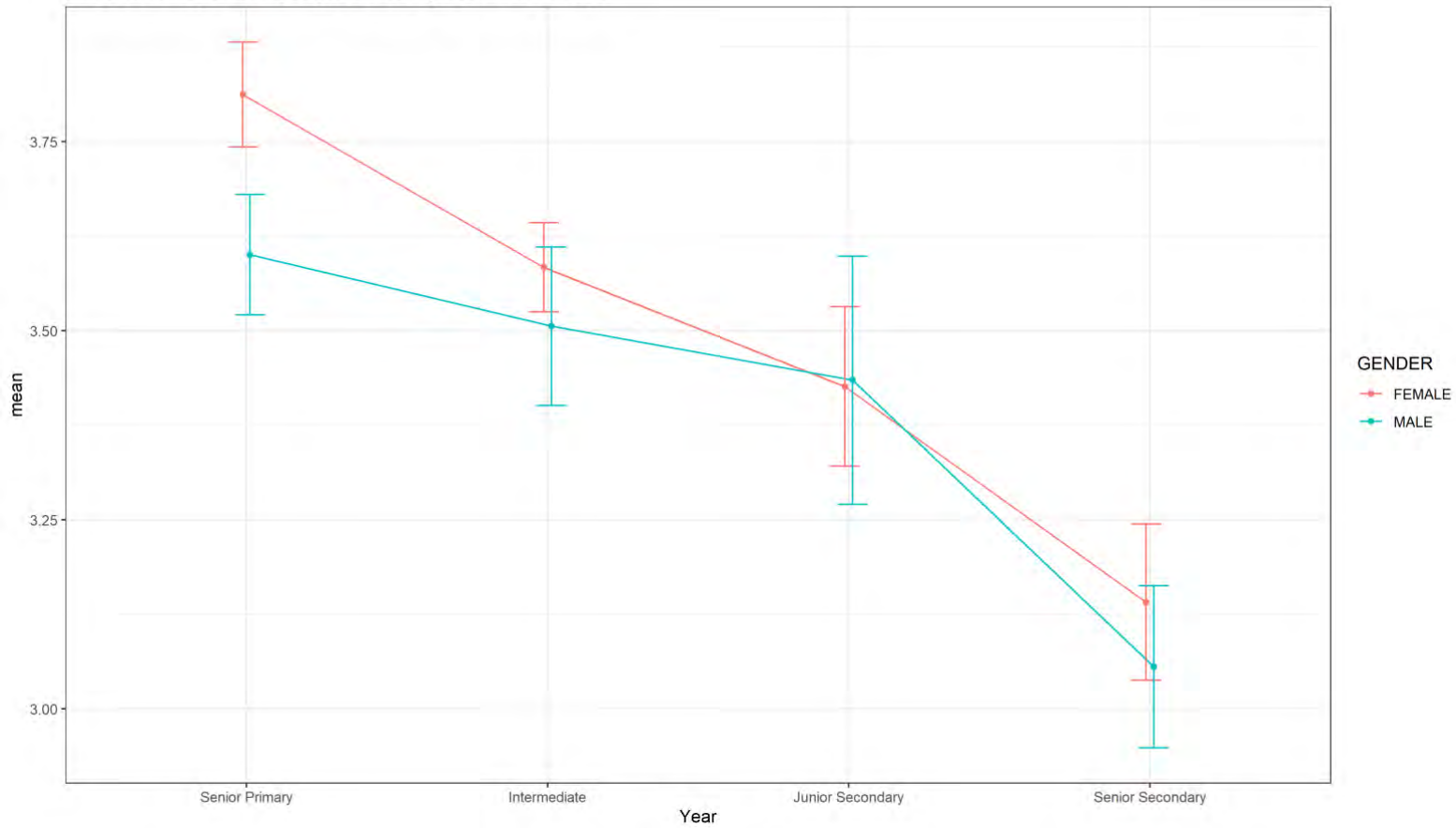
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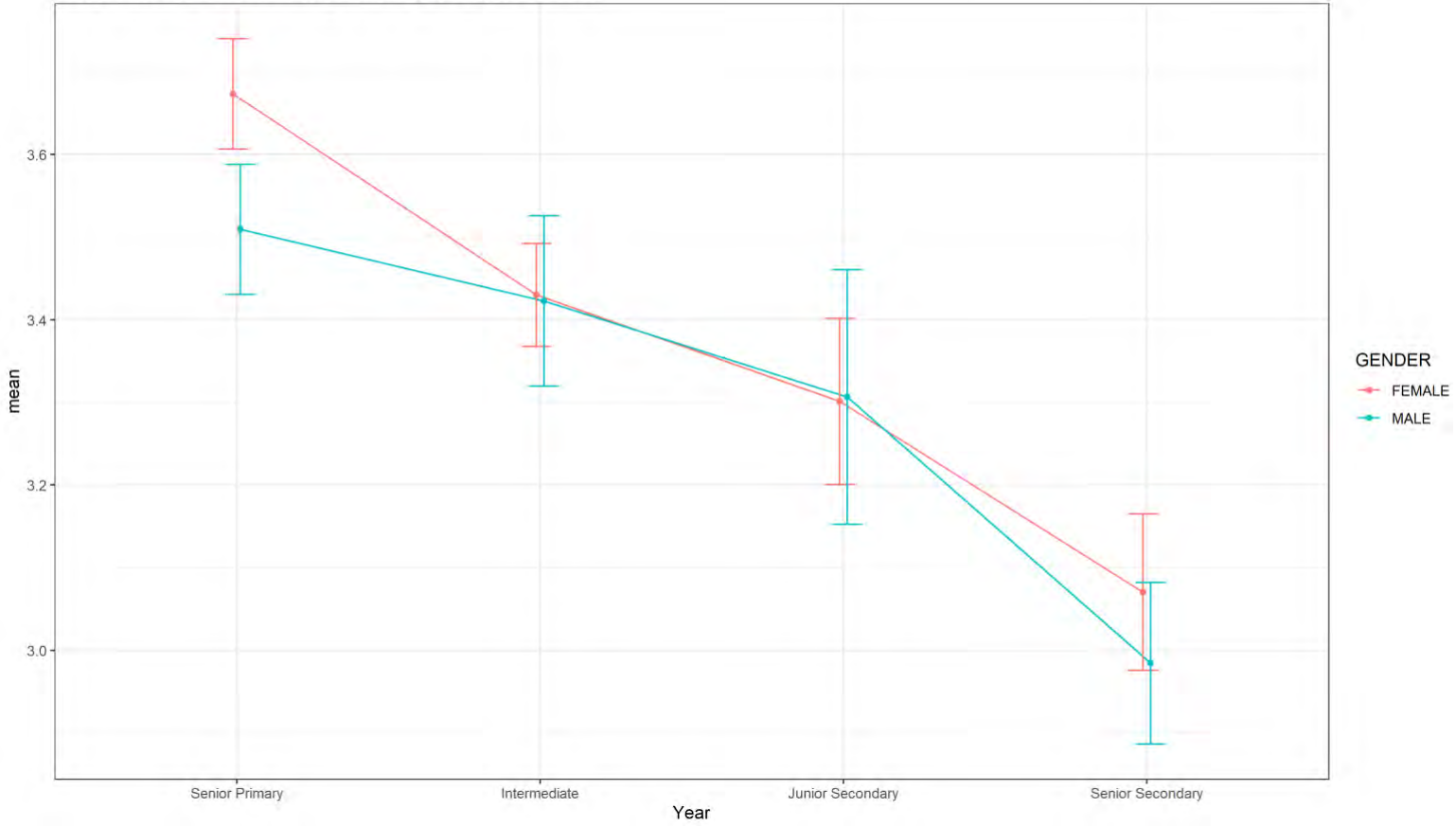
## Supplementary Figures

*The levels of endorsement of the CSI index variables, validation variables, and CSI composite variables by Year and Gender.*

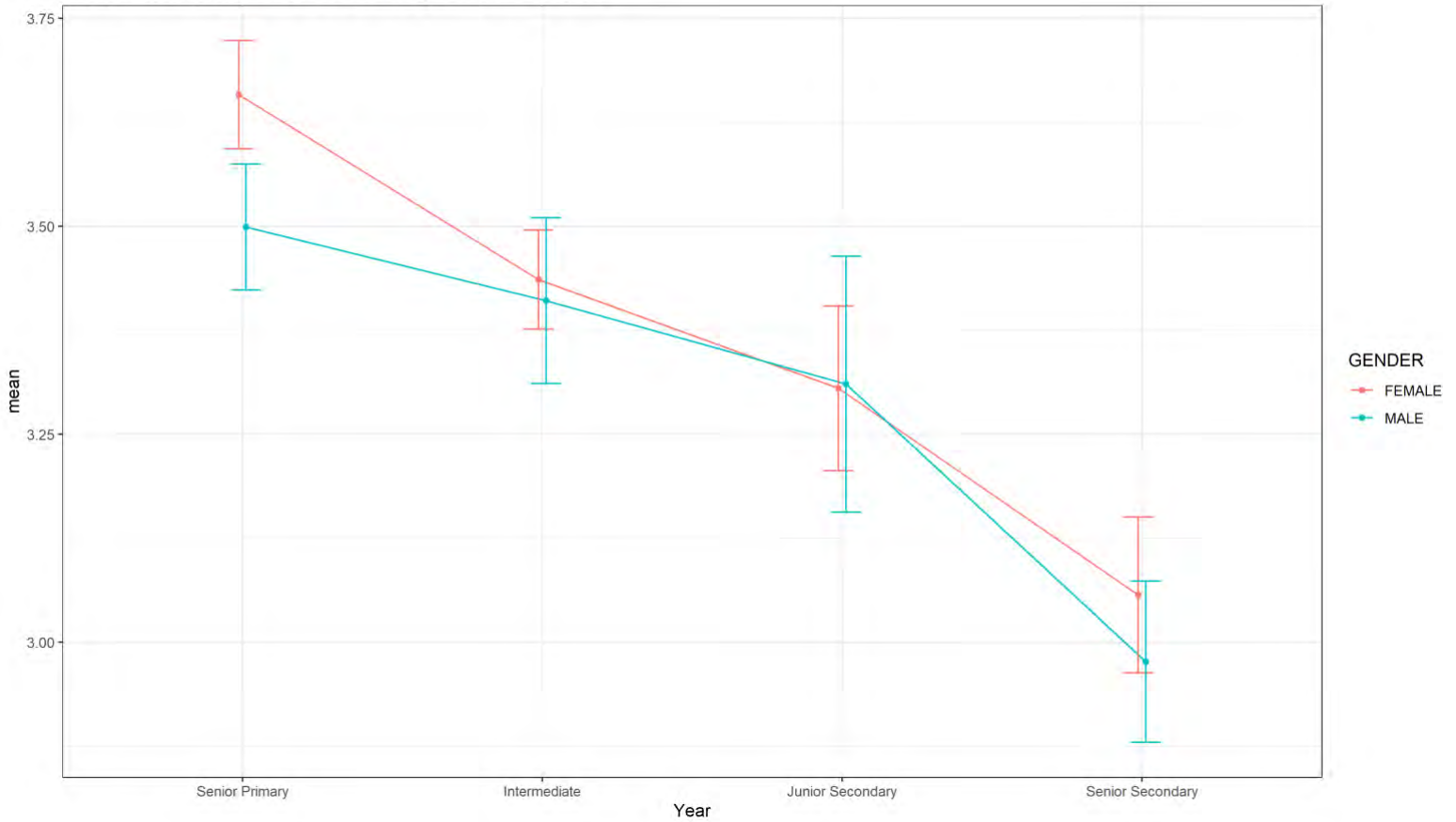
Plot for Creative Classroom 11 items by Year and Gender



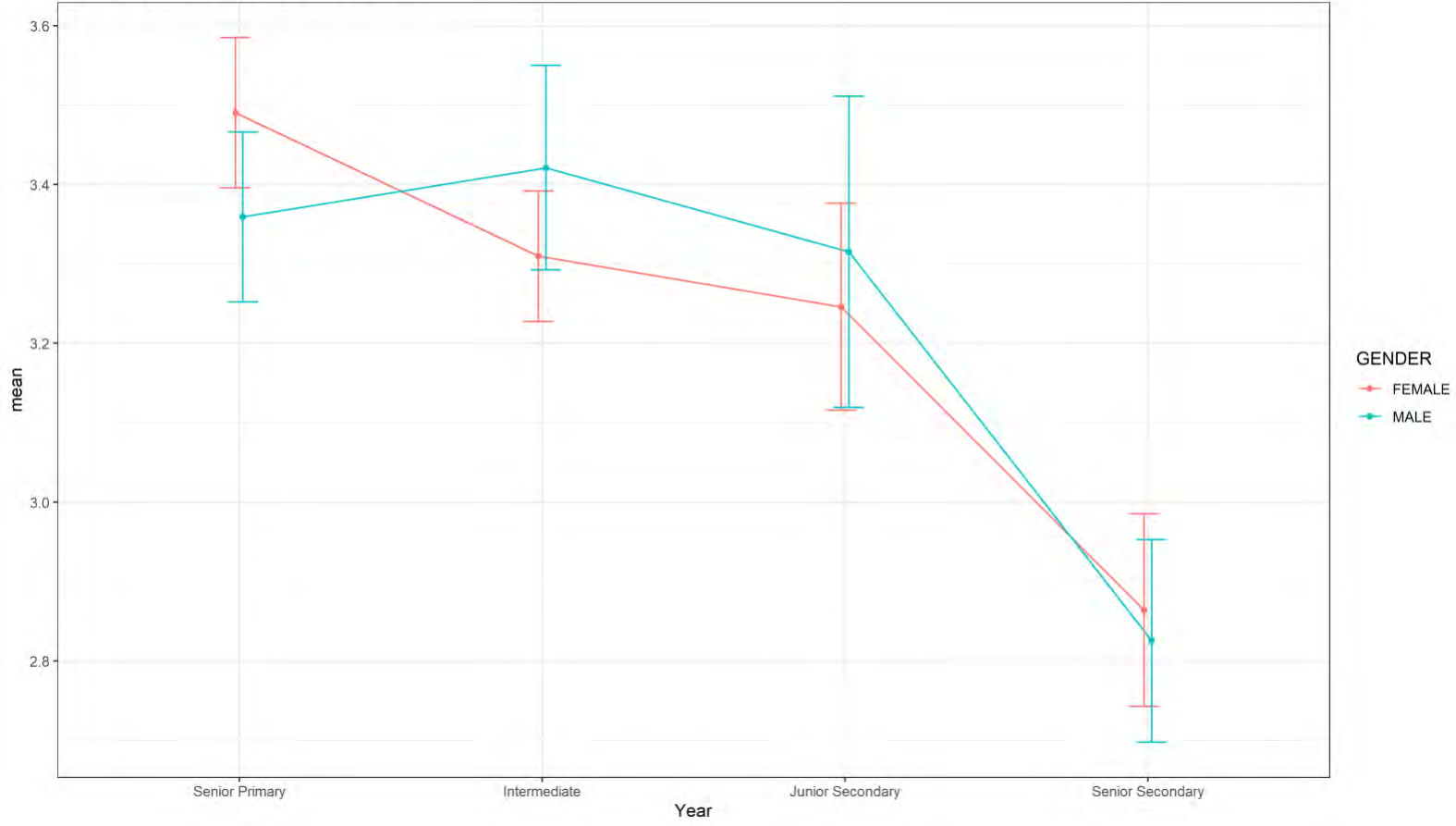
Plot for Creative Classroom 44 items by Year and Gender



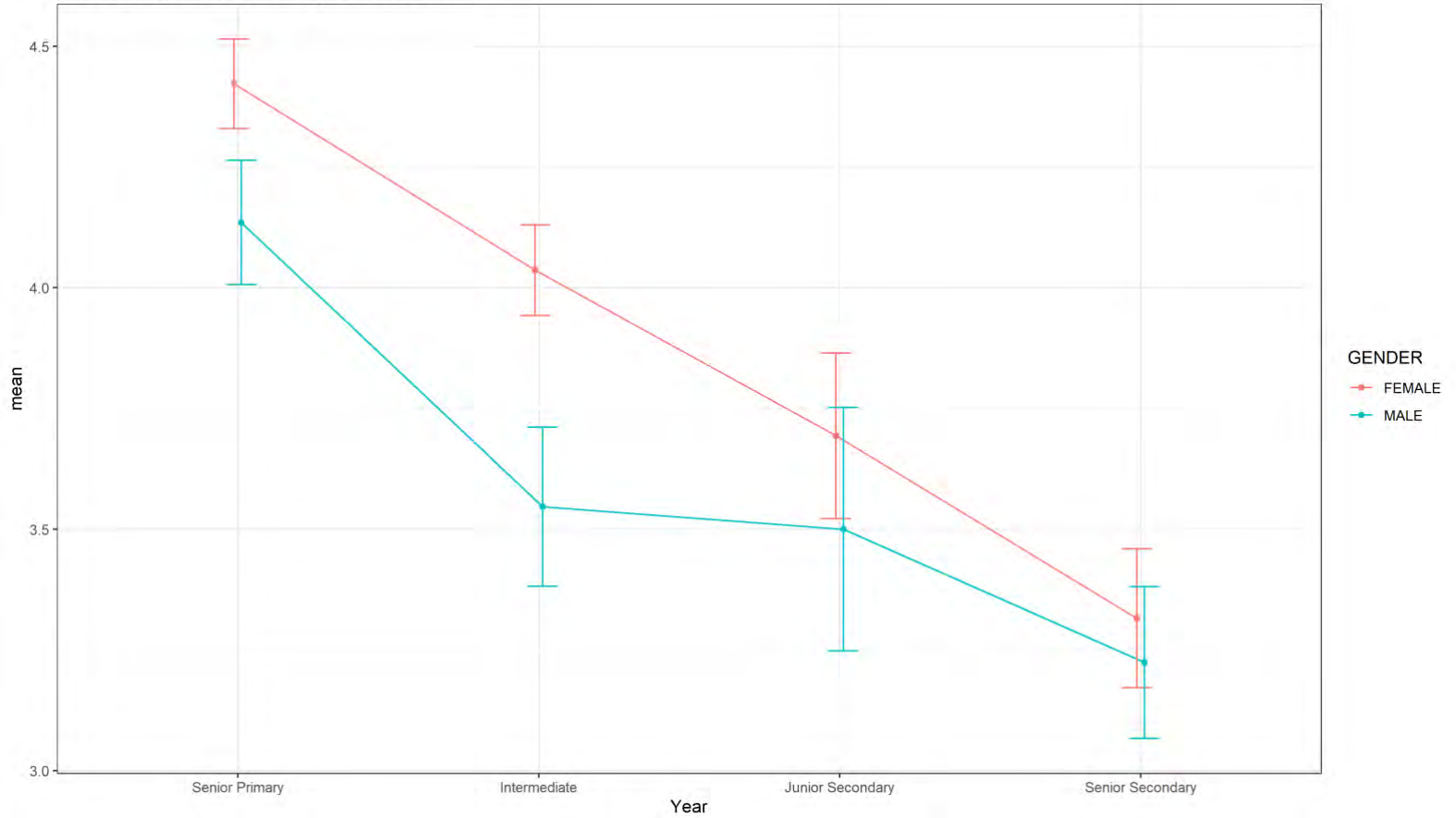
Plot for Creative Classroom 56 items by Year and Gender



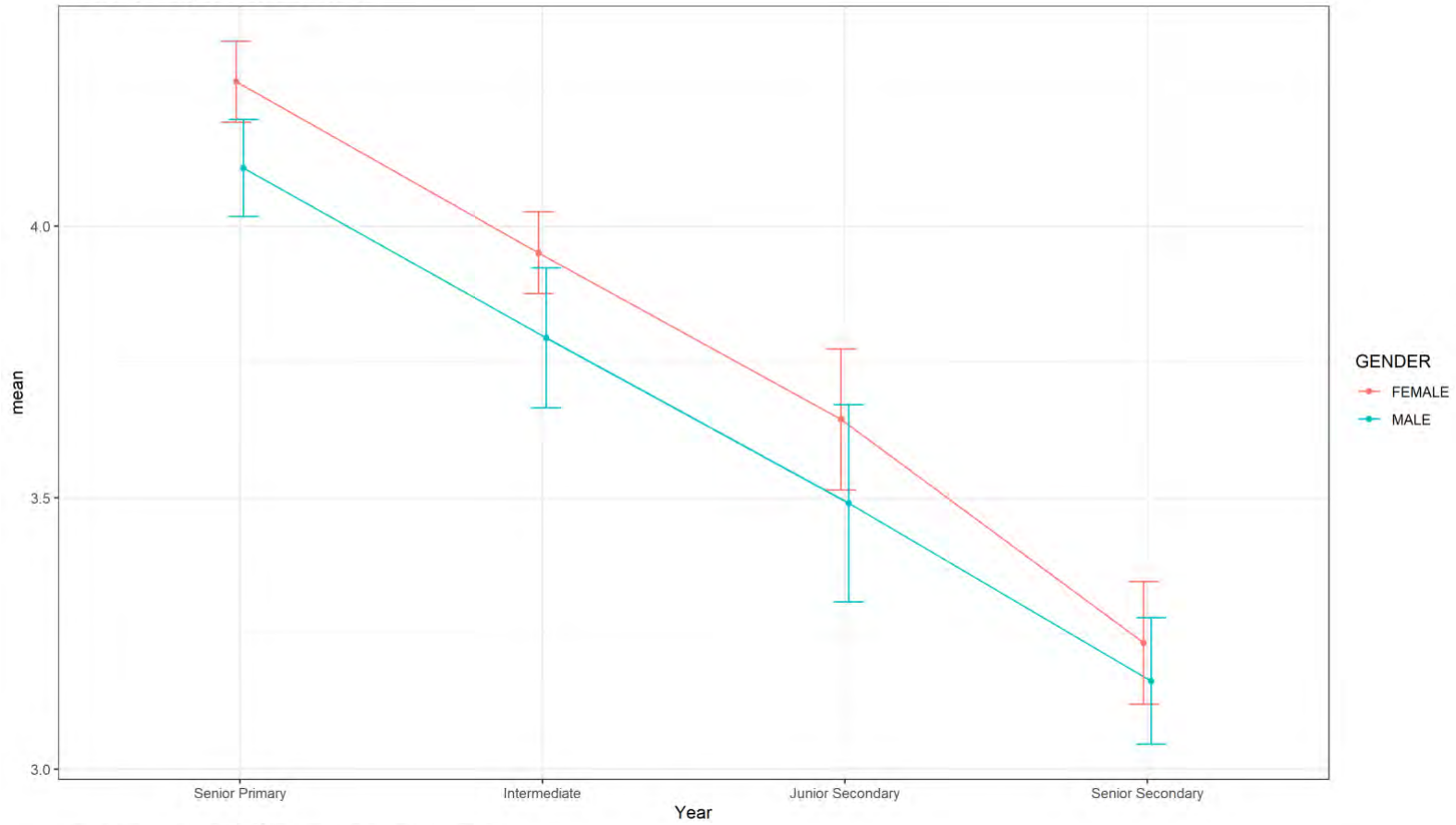
Plot for Synthesis by Year and Gender



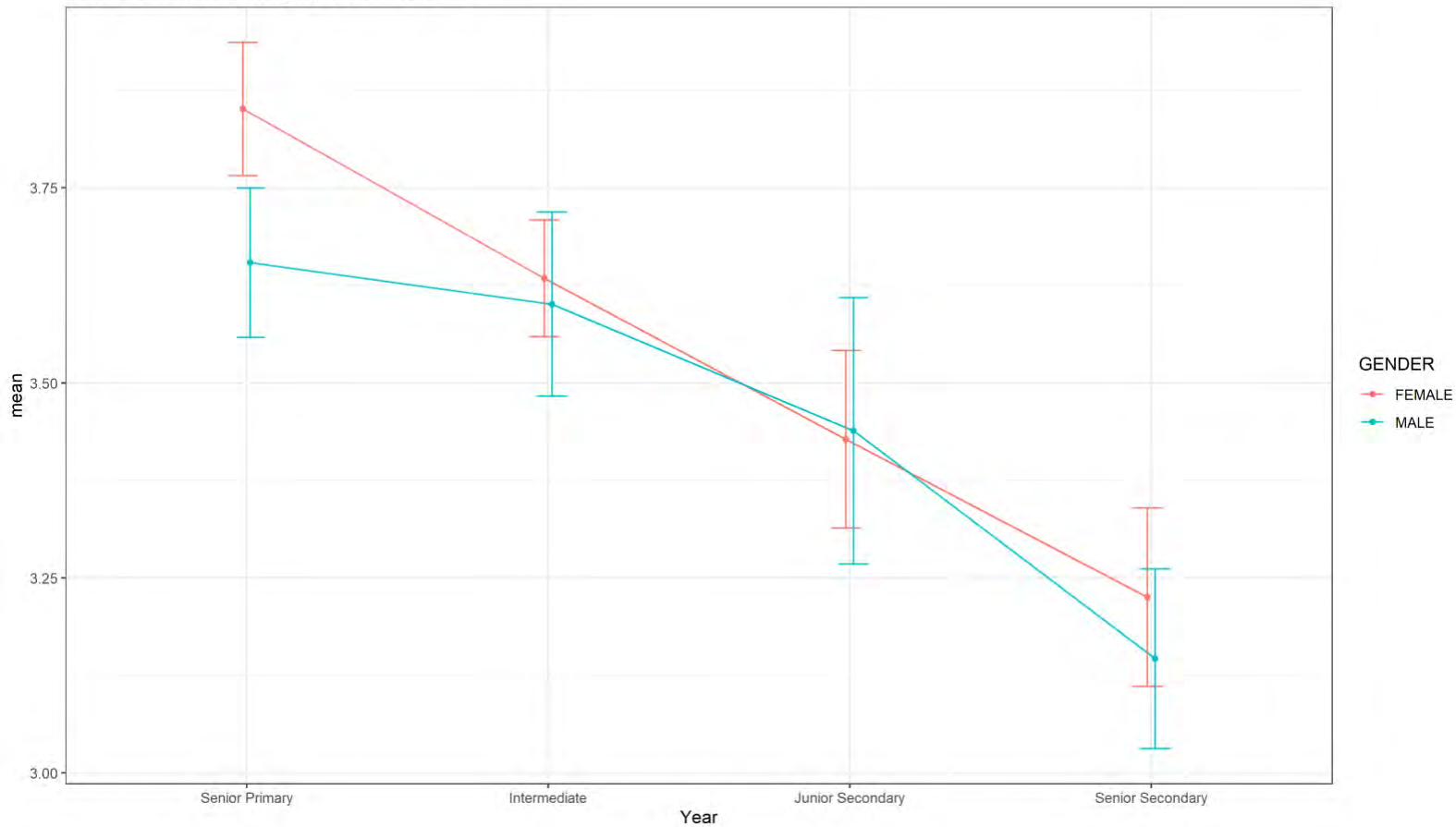
Plot for School Enjoyment by Year and Gender



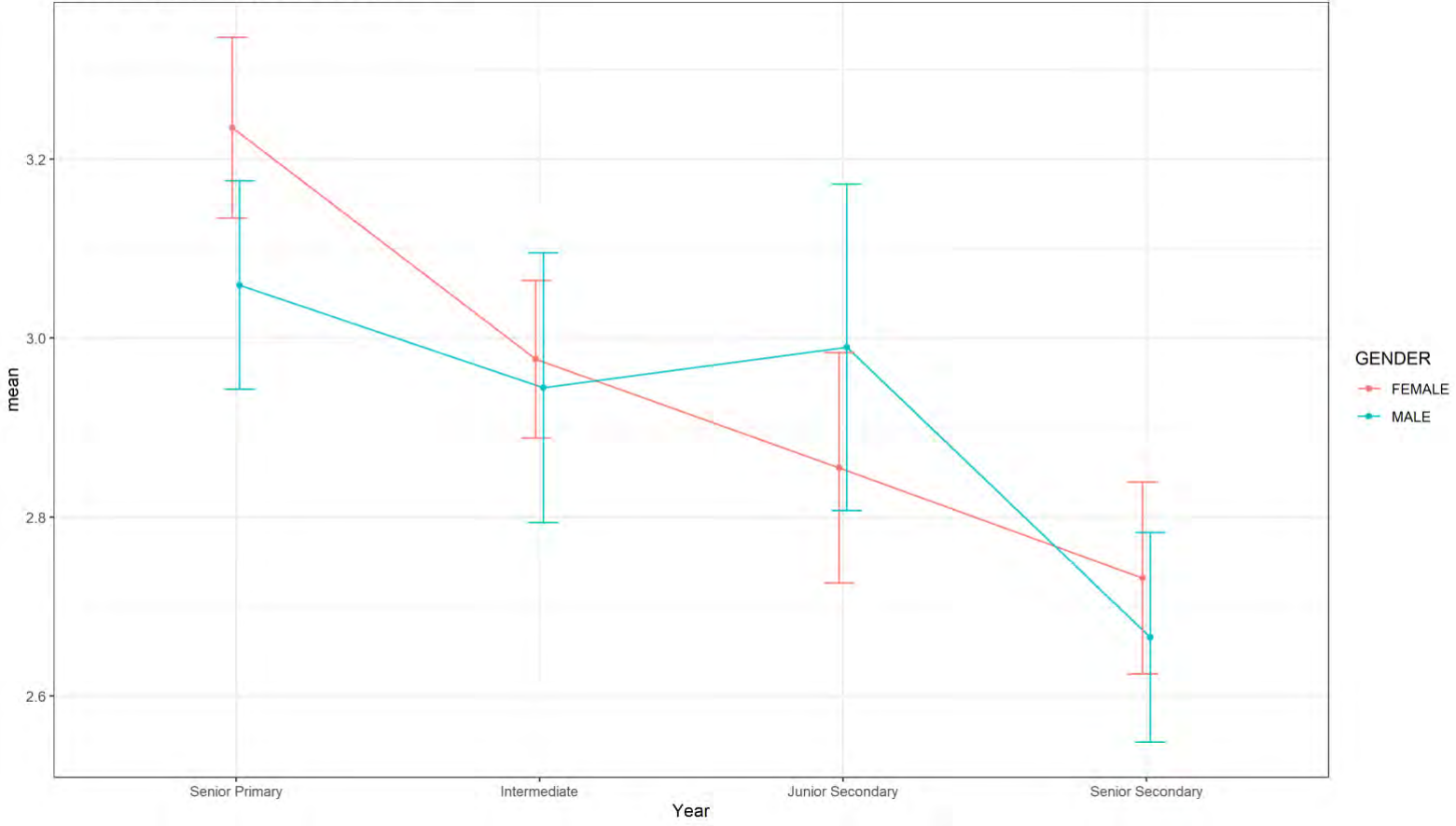
Plot for Risk by Year and Gender



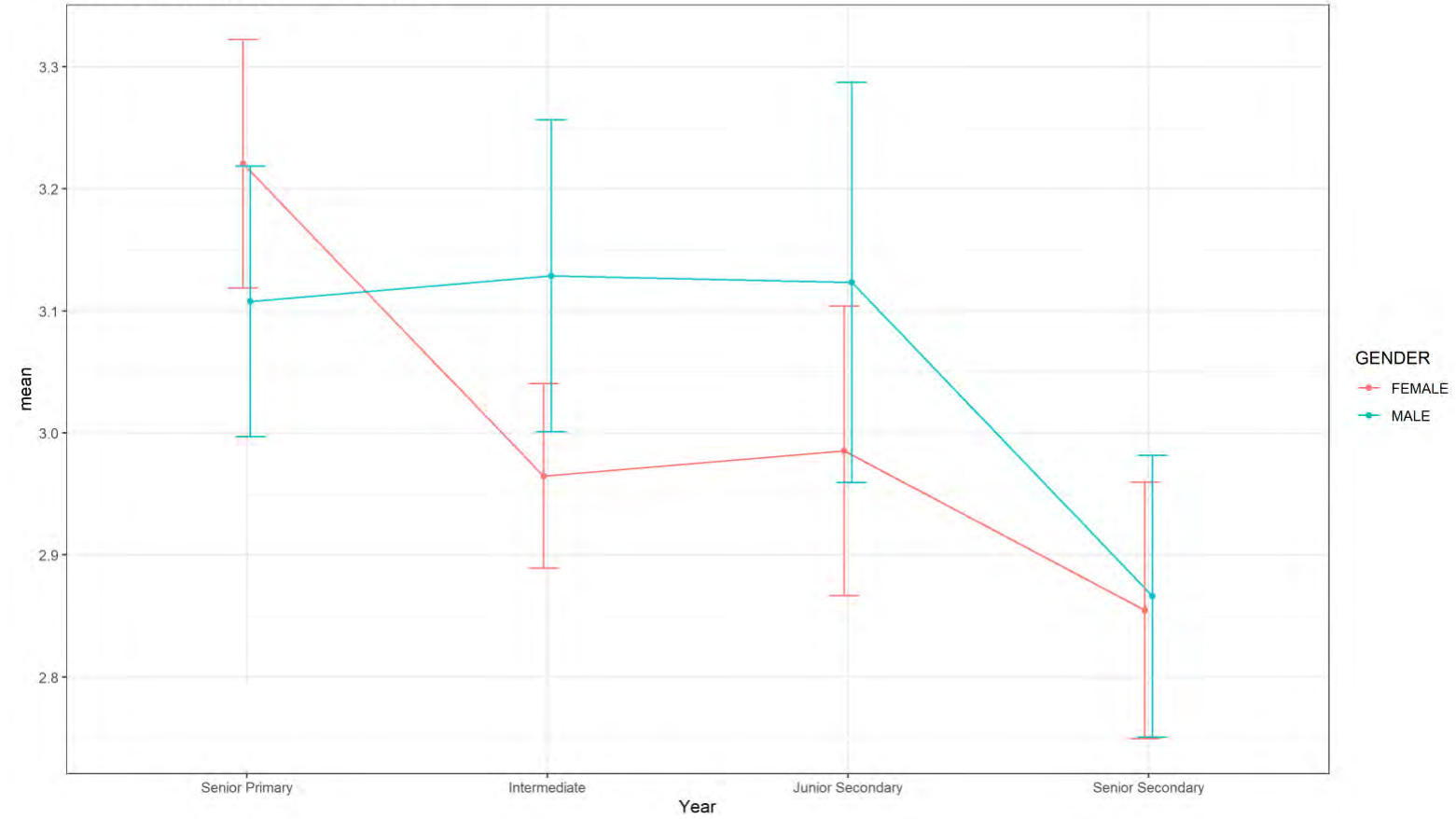
Plot for Problem Solving by Year and Gender



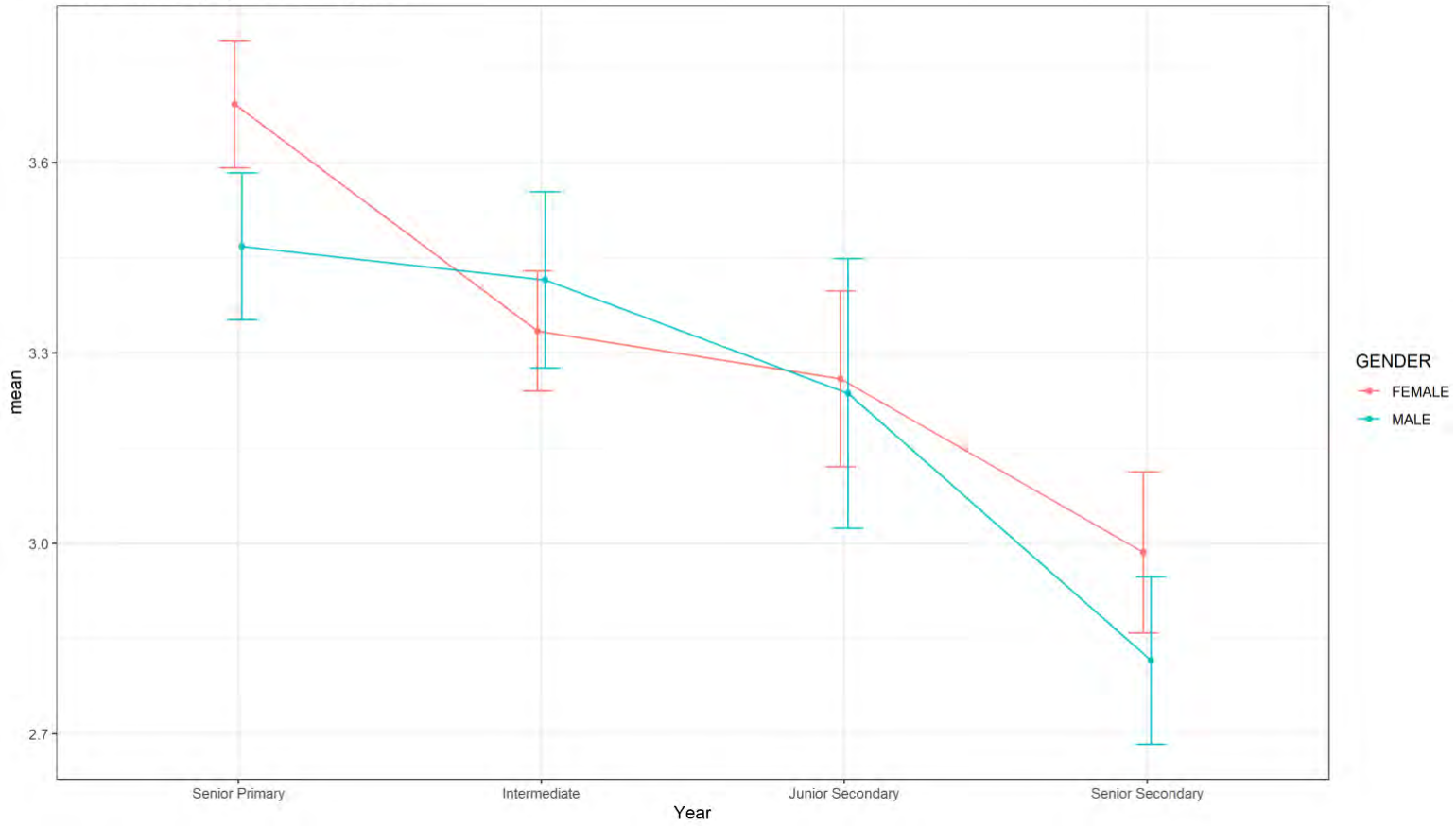
Plot for Playfulness by Year and Gender



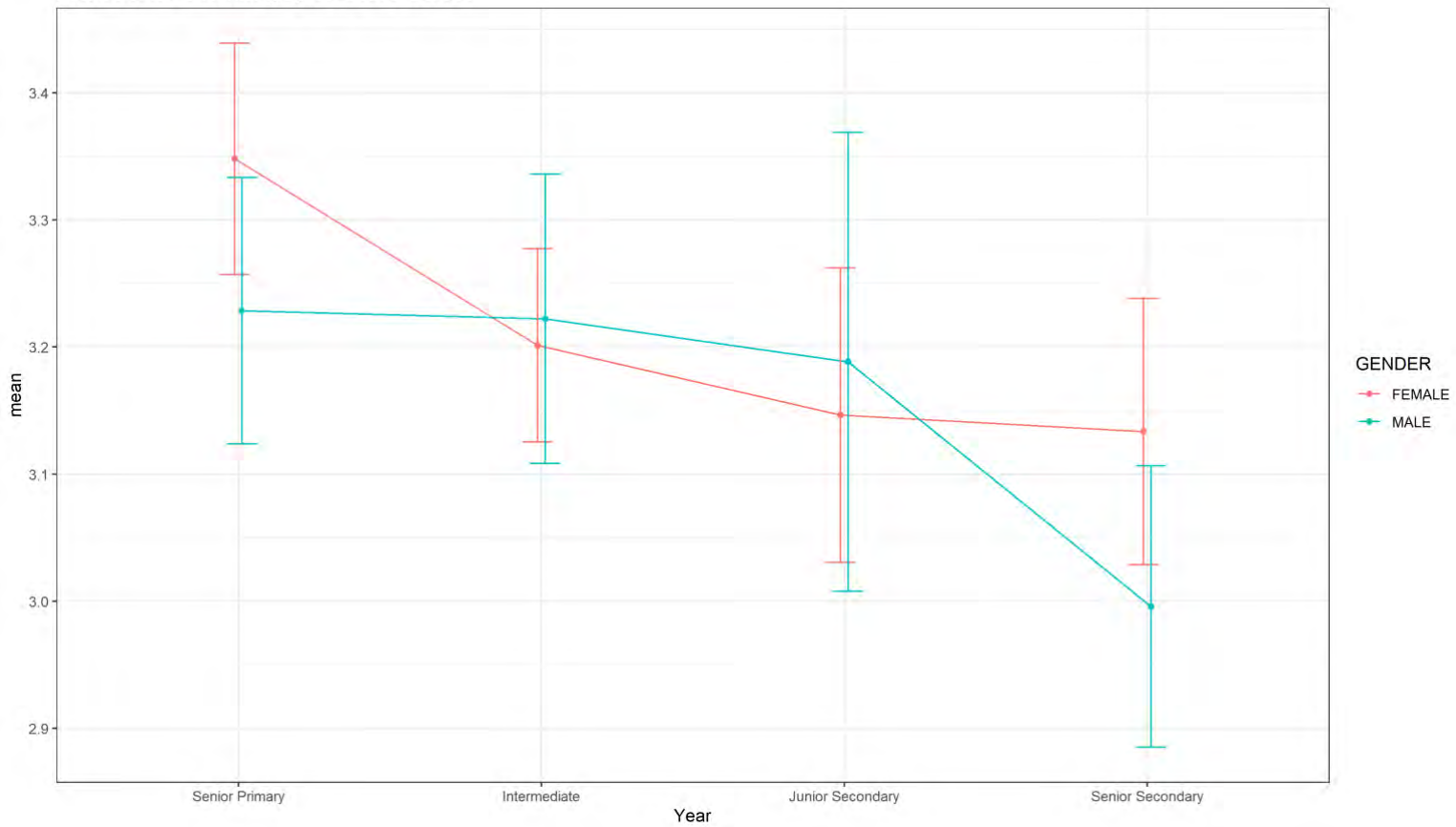
Plot for Innovation by Year and Gender



Plot for Curiosity by Year and Gender

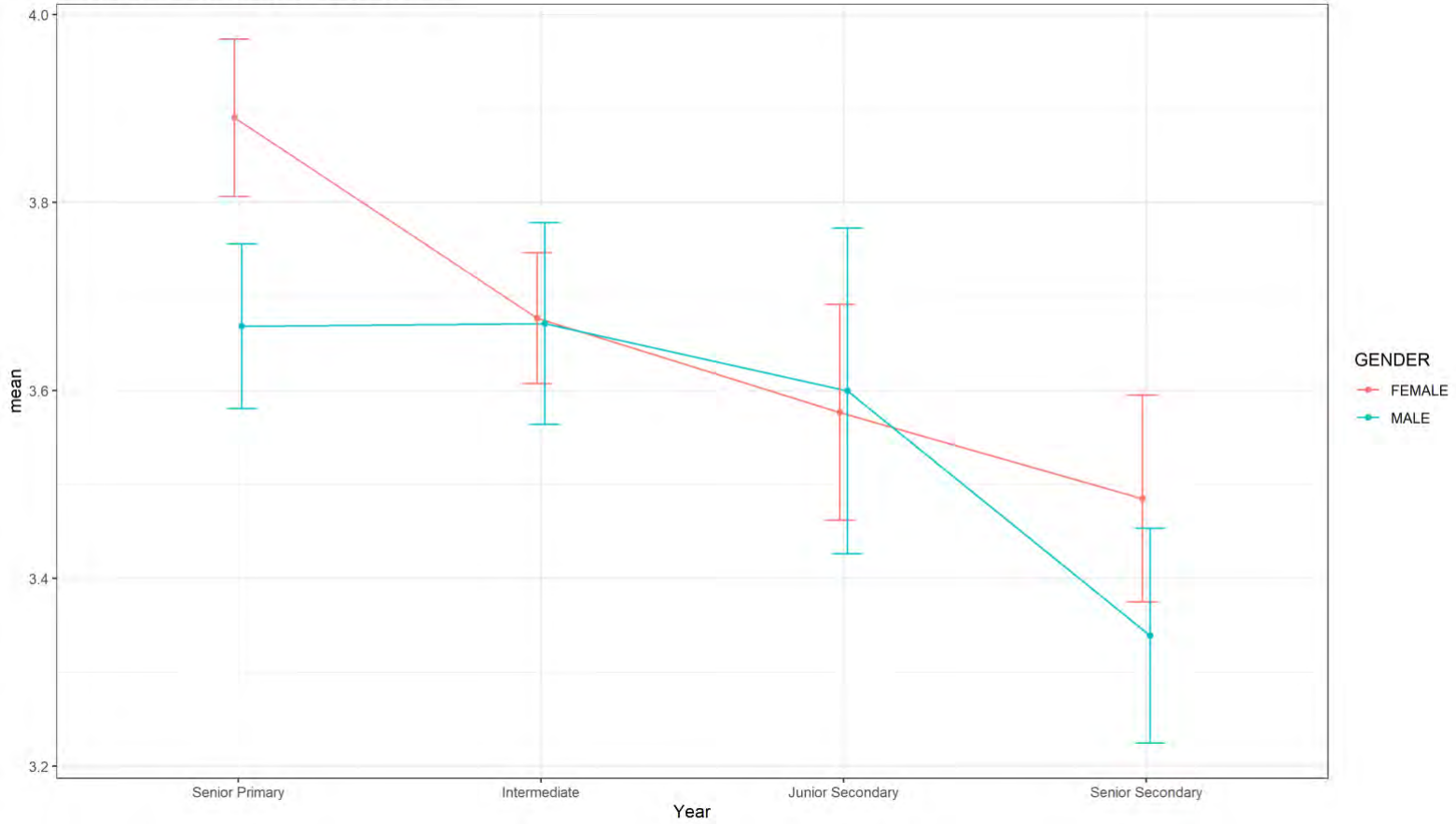


Plot for Critical Thinking by Year and Gender





Plot for Collaboration by Year and Gender



Plot for Classroom Participation by Year and Gender

