



A Latent Growth Curve Model of the Relationship Between Computer Usage and Academic Performance in a Longitudinal Sample of Irish Children

Author: Desmond O' Mahony
Research Analyst ESRI

Contact: desmond.omahony@esri.ie

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Technology in the Home

- Presence of computers and other internet enabled devices approaching saturation Europe wide
 - (EU – Kids online, 2004 to 2014)
- Many homes now have multiple devices making supervision and monitoring difficult
- Children using computers at earlier ages and for longer than ever before with important consequences for habit formation and for developmental trajectories in multiple domains
- Evidence for low overall digital literacy
 - (European commission 2013)



Computer Usage, Applications and Educational Outcomes

- Computer use has varied effects on academic performance. Mixed effects reported varying by **usage** intensity and **application** types.
- Some evidence for Impaired memory and concentration
 - Johnson (2006)
- Academic advantages have been seen in several large scale studies:
 - Programme for International Student Assessment (PISA) (OECD,2005)
 - Longitudinal Study of Australian Children (Fiorini, 2010)
- Previous Research using GUI data at 9 years shows both positive and negative effects of computer use (Casey et al. 2012)



Summary - Casey et al (2012)

Summary of Casey et al (2012)

- Importance of controlling for social gradient in test outcomes
 - (Williams et al 2009)
- Better test outcomes at 9 years
 - Moderate computer usage
 - Unsupervised computer usage
 - Informational computer applications
- Worse test outcomes at 9 years
 - Social media use

Aims of current study

- Replicate and extend initial findings of Casey et al (2012)
- Move from cross sectional to a longitudinal view



Data Source for the Current Study

- Child Cohort GUI Anonymised Microdata File (AMF)
- **Sample size**

| | | |
|----------|-------|------------------------------|
| • Wave 1 | 9yrs | Unweighted sample of - 8,568 |
| • Wave 2 | 13yrs | Unweighted sample of - 7,525 |
| • Wave 3 | 17yrs | Unweighted sample of - 6,210 |
- Pure fixed panel design
- Evidence of differential attrition across waves (Williams, 2009).
Re-weighted using census information



Educational Performance Variables

- **9 Year Data**
 - Drumcondra Primary Maths Test
 - Drumcondra Primary Reading Test
- **13 Year Data**
 - Drumcondra Numerical Ability Test
 - Drumcondra Verbal Reasoning Test
- **17 Year Data**
 - Junior Certificate Mathematics
 - Junior Certificate English
- **Scoring Junior Certificate**
 - Junior Certificate (Grade A-E)
 - Junior Certificate level (Higher, Ordinary, Foundation)
 - Scale constructed following a coding scheme producing a Leaving Certificate points total equivalent range 10-100



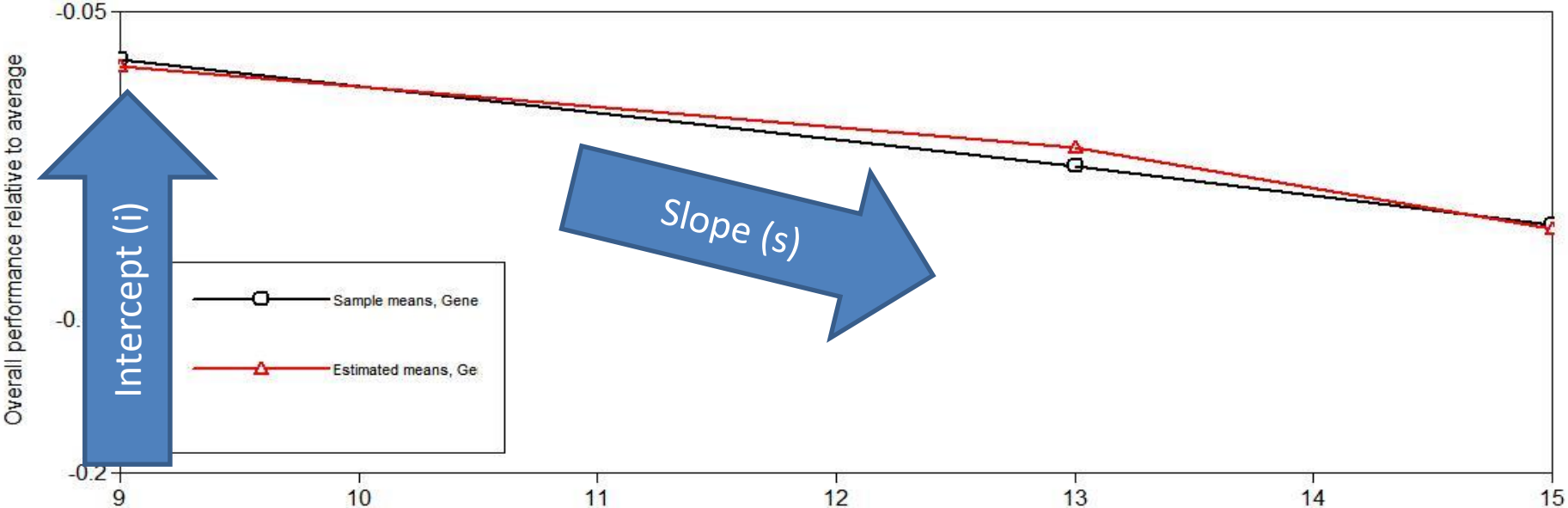
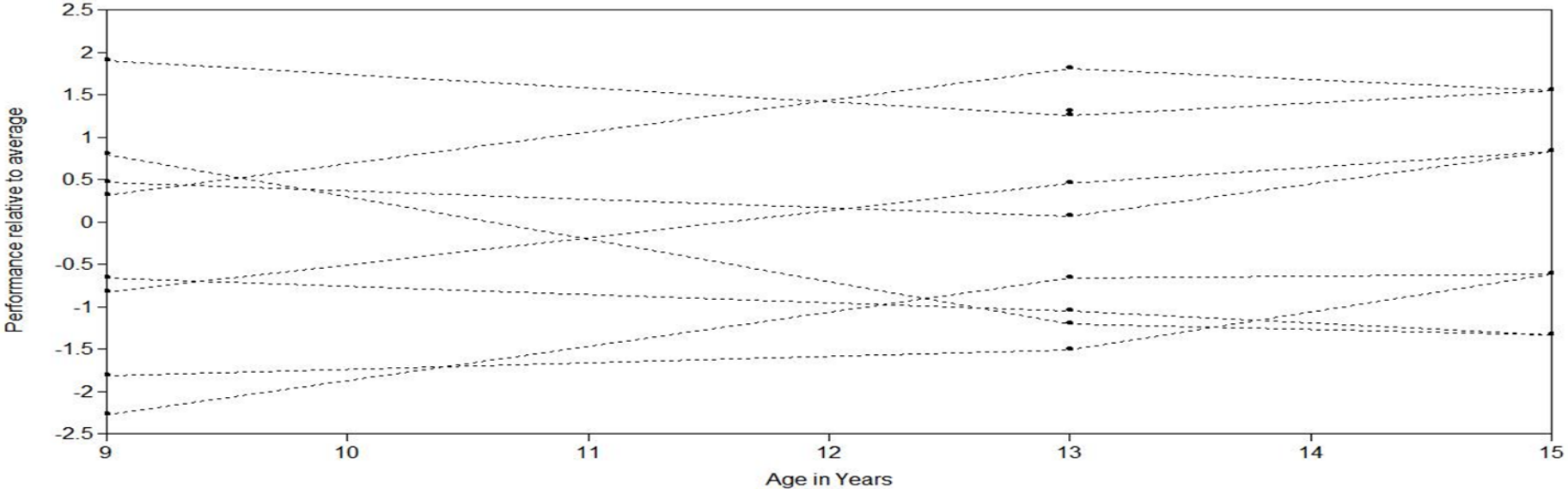
Educational Variable Parameterisation

- **Parameterisation across variables problematic:** An assumption of growth modelling requires variables to be on the same scale.
- **Current solution:** All educational variables re-scaled as z-scores such that an average performance has a mean score of zero and SD of one.
- **Useful effects of parameterization strategy:**
 - Flattening of growth curve.
 - Intercept is free to vary across participants.
 - The average slope for the whole sample is close to zero.
 - Primary interest is in explaining variability in intercept and slope at an individual level



Growth Model example

(Mathematics scores at 9, 13 and 17)





Statistical models developed

Set up initial growth curve models

- Model 1: Baseline model
- Model 2: Household Level covariates
- Model 3: Child level covariates

Computer Usage and Applications Models

- Model 4: Specific applications used at 9 and 13
- Model 5: Changes in behaviour between 9 and 13

Summary of Model Fit Statistics

Baseline models 1-3 Covariates (Casey et al. 2012)

- PCG/SCG Education
- HSD Structure
- HSD Social class
- Equivalised Income
- Child gender
- Child early reading

Model Fit Statistics support all models

- Chi-sq to df ratio ✓
- CFI values above 0.9 ✓
- RMSEA values below 0.10 ✓
- SRMR values below 0.10 ✓

Computer Applications

• Applications used at 9

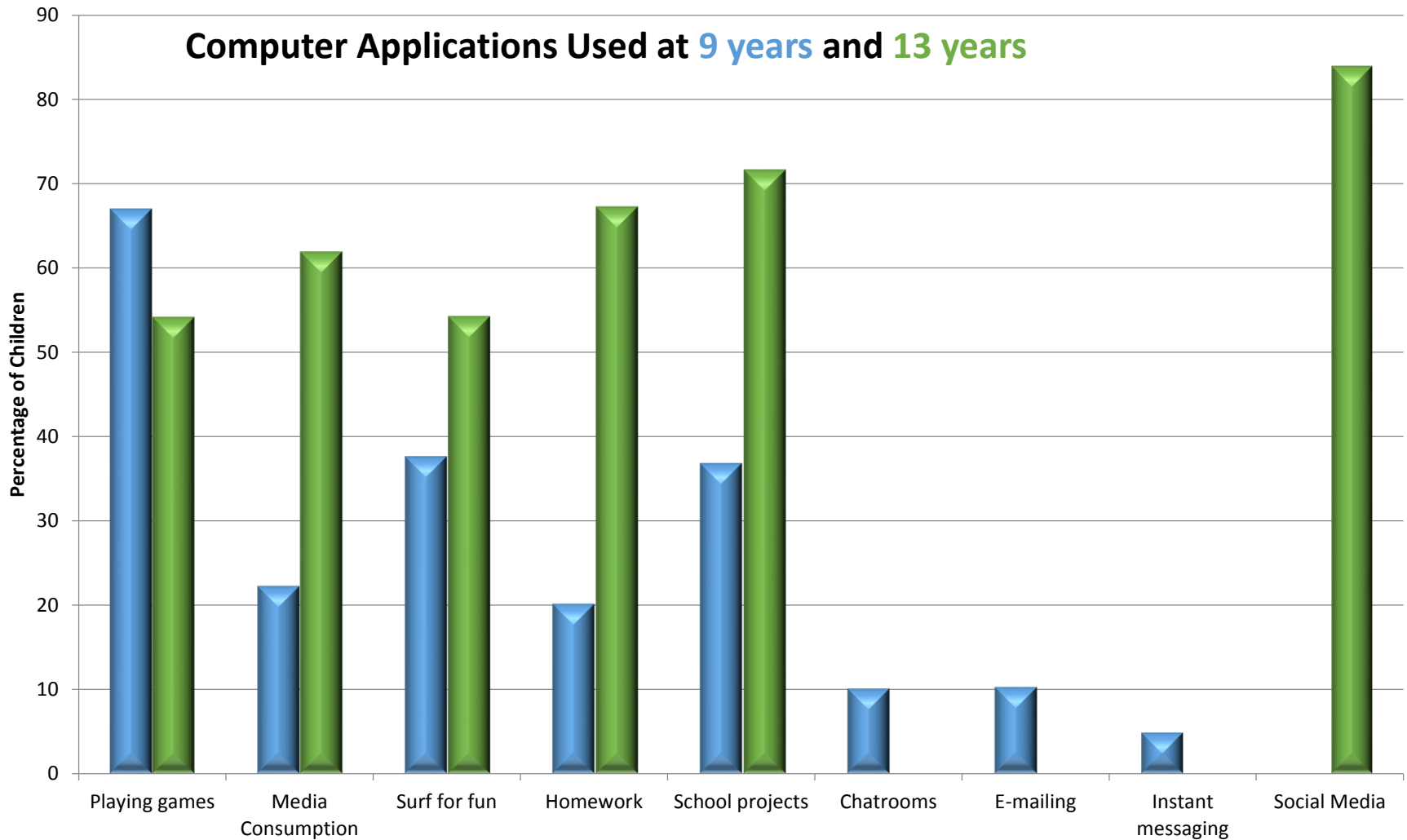
- Playing games
- **Chatrooms**
- Media Consumption
- **E-mailing**
- **Instant messaging**
- Surf for fun
- Homework
- School projects

• Applications used at 13

- Playing games
- **Social Media**
- Media Consumption
- Surfing for fun
- Homework
- School Projects

Model 4: Applications

Descriptives: Applications used





Model 4 Summary

Specific applications used

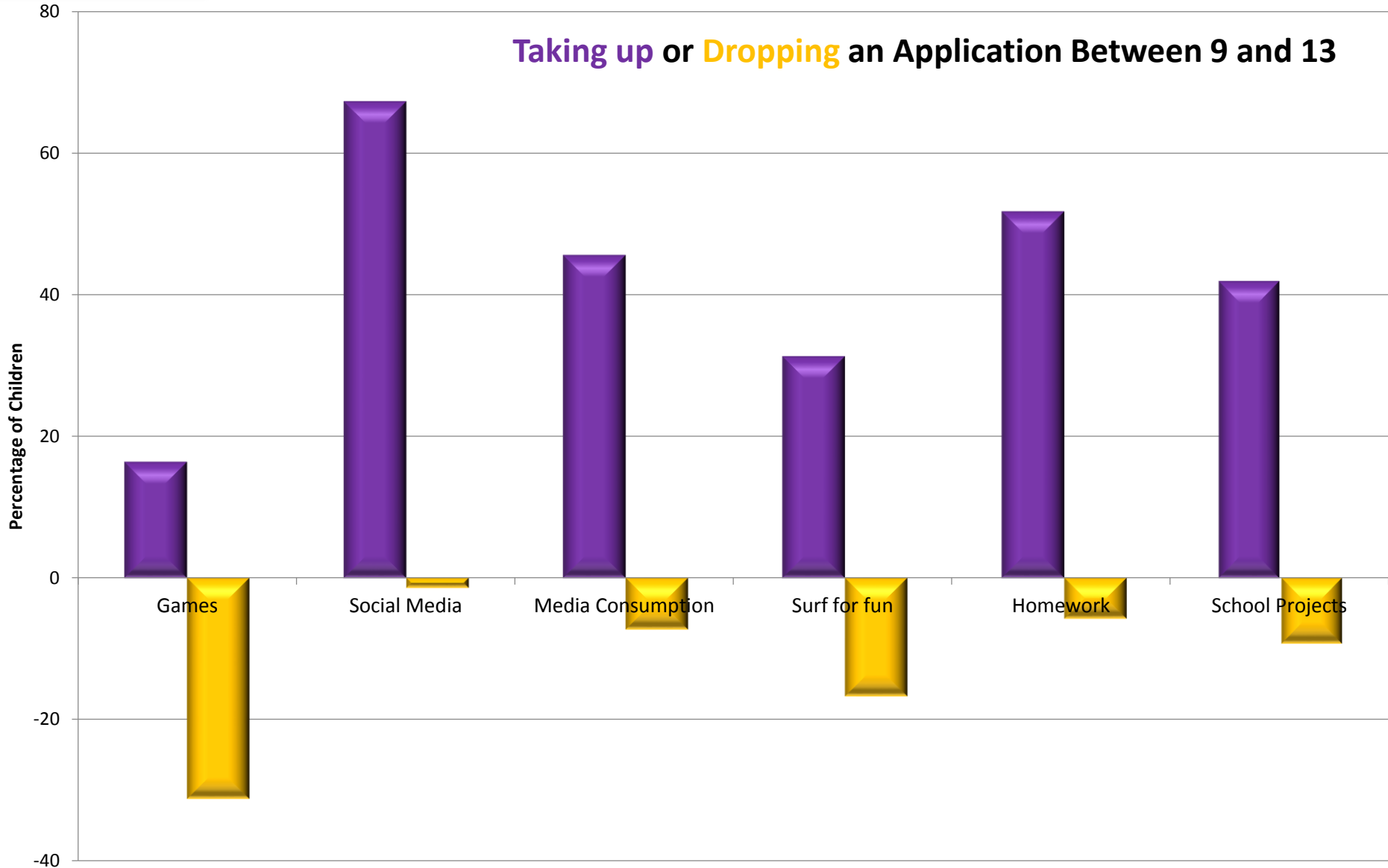
| | Initial effects at 9 years (Intercept) | Mathematics β | Reading β |
|----------------------|---|------------------------|---------------------|
| 9 year applications | School projects | 0.09** | 0.12*** |
| | Homework | -0.01 _{ns} | -0.04 _{ns} |
| | Chatrooms | -0.01 _{ns} | -0.04 _{ns} |
| | Playing Games | 0.13*** | 0.09** |
| | Surfing for fun | 0.07* | 0.08** |
| | Instant messaging | -0.20** | -0.20** |
| | E-mailing | 0.10* | 0.16*** |
| | Movies/Music | -0.12*** | -0.17*** |
| | Change over time (Slope) | Mathematics β | Reading β |
| 13 year applications | School projects | 0.08*** | 0.08*** |
| | Homework | 0.05** | 0.03* |
| | Social media | -0.11*** | -0.06** |
| | Games | 0.00 _{ns} | -0.03* |
| | Surfing for fun | 0.00 _{ns} | 0.03* |
| | Movies/Music | -0.03** | -0.01 _{ns} |

- Findings of Casey et al 2012 are largely replicated.
- Early informational and fun uses of computer associated with better initial outcomes
- Longitudinally, there is support for consistent positive effects for informational patterns of usage
- Consistent negative effects are also seen for consumptive/ interruptive patterns computer usage

* P < .1, ** p < .05, *** p < .001



Descriptives: Uptake/Dropping of Applications Between 9 & 13





Model 5 Summary

Changes in behaviour

| | Change over time (Slope) | Mathematics β | p-value | Reading β | p-value |
|---|-----------------------------|------------------------|---------|--------------------|---------|
| Take up activity between 9 and 13 | Games | -0.04 | ns | -0.06 | ** |
| | Social Media | -0.04 | ** | 0.00 | ns |
| | Videos/Music | -0.03 | ** | -0.03 | ns |
| | Surf for Fun | 0.00 | ns | 0.02 | ns |
| | Homework | 0.05 | ** | 0.03 | ns |
| | Projects for School | 0.06 | ** | 0.09 | *** |
| Drop activity between 9 and 13 | Games | 0.02 | ns | 0.01 | ns |
| | Social Media | 0.06 | ns | 0.08 | * |
| | Videos/Music | -0.02 | ns | -0.02 | ns |
| | Surf for Fun | -0.04 | * | -0.03 | ns |
| | Homework | 0.02 | ns | 0.02 | ns |
| | Projects for School | -0.03 | ns | -0.05 | * |

Information gained from behaviour change model strengthens previous analysis

Additional support for “ladder of opportunities” or informational vs consumptive/ interruptive uses classification

Positive effect on reading for dropping social media in early teens is a theoretically consistent but tentative finding

* P < .1, ** p < .05, *** p < .001



Implications

- Findings are supported both **cross-sectionally** and **longitudinally**
- Evidence that informational computer use supports better educational outcomes
- Evidence that Media consumption and Social Media use have negative effects on educational outcomes
- Support for “Ladder of opportunities” concept
 - (Livingstone et al 2011)



Opportunities

- Structured guidelines on screen time could help parents know when to limit their children's activities
 - www.makeastart.ie (Safefood, 2018)
- Guidelines should also include information on beneficial types of activities on computers and mobile devices
- Endless potential to use access to media and games as a powerful behavioural motivator for success
 - Game based learning
 - Age appropriate reward charts / targets
 - Increased parental controls on systems



Future Research

- Challenges of parameterisation of educational outcomes
- Application by Usage interactions
- Possibilities of establishing classes of use and their consequences
- Develop useful guidelines for age appropriate activity cutoffs



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Questions, comments and suggestions
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Contact: desmond.omahony@esri.ie