

,Q WKH FRQWH[W RI ,QWHULR  
GHSDUWPHQWV LQ 7XUNH\ 'HVLJQ  
HGXFDFWLRQ

6HUSLO 01023(2016) 26:01023

,úŃN 8QLYHUVLW\ )DFXOW\ RI )LQH \$UWV 'HSDUWPHQW RI ,Q  
,úŃN 8QLYHUVLW\ )DFXOW\ RI \$UFKLWHFWXUH DQG 'HVLJQ 'H  
7XUNH\

\$EVWUDFW FRXUVHV RI GHVLJQ VWXGLR DUH WKH PRVW  
HGXFDFWLRQ DV DQ HVVHQWLD SDUW RI LQWHULRU D  
DUHDV ZKHUH WKLQNLQJ DQG GHVLJQ VNLOOV RI WKH  
GLIIHUHQW IURP RWKHU FRXUVHV ,QFUHDVHG QXPE  
DFDGHPLF PHPEHU LQ WKH SURMHFW FRXUVHV FRQG  
V\VWHP KDV UHVXOWHG LQ IDLOXUH WR VXVWDLQ SUR  
DQG UHGXFHG WKH SURGXFWLYLW\ TXDOLW\ RI HGX  
SXUSRVH RI WKLV VWXG\ LV WR DGGUHV WKH HGXF  
YDULRXV IRUPV LQ WKH GHVLJQ VWXGLR FRXUVHV  
GHSDUWPHQWV LQ 7XUNH\

.H\ZRUG WHULRU DUFKLWHFWXUH LQWHULRU DUFKLW  
VWXGLR FRXUVH SODQ

,QWURGXFWRQ

,QWHULRU \$UFKLWHFWXUH LV RQH RI WKH PRGHUQ  
ZLWK WKH LPSDFW RI VRFLR FXOWXUDO DQG HFRQRPLF  
,QWHULRU \$UFKLWHFWXUH HGXFDFWLRQ LV EHLQJ VKDS  
DUFKLWHFWXUH HGXFDFWLRQ LV SDUWLFXODUO\ JXLGHG  
GHVLJQ VWXGLR LQ HGXFDFWLRQ LV VXEVWDQWLD SDU  
DFW LV D FRQFHSW LQYROYLQJ FUHDWLRQ RI D QHZ  
EHIRUH > @ 'HVLJQ LV D FUHDWLYH SURFHVV DQG WKH  
SURIHVVRQV DQG WKH HGXFDFWLRQ LV WKH GHYHORSP  
DQG GLUHFWRQV 7KH SXUSRVH RI SURIHVVRQDO V  
\$UFKLWHFWXUH HFW LV WR FRQYH\ WKH PHWKRQ DQG  
'HVLJQ HGXFDFWLRQ LV DQ HGXFDFWLRQ PRGHO WKDW Y  
VWXGHQW DQG ZKLFK LV UHDOLJHG WKURXJK WKH NQRZ

© &RUHHVSRQGLQJ DXWKRU HOLI VX\XN#LVLNXQ HGX WU

SUREOHPDWLF DQG IRUPDWLRQ RI PHWKRGV WKDW HQD  
 > @ 'HVLJQ VWXGLR LQFOXGHV D FRPELQHG XVH RI RV  
 SURFHVV WR OHDUQ DQG GHYHORS WKH DFW RI GHVLJQ  
 DV SDUW RI GHVLJQ VWXGLR WR EH FRPSOHWHG DW  
 \$UFKLWHFWXUH GHSDUWPHQWV LW LV XVXDOO\ SUHV  
 UHTXLUHV RQO\ SURMHFW GHOLYHU\ 'HVLJQ VWXGLR  
 HYDOXDWLRQ RI WKH SURMHFW E\ GLIIHUHQW DFDGHPL  
 RQH WR RQH LQWHUYLHZV UHVLVLRQV DQG FULWLFV EY  
 SK\VLFD RXWFRPH WKH DEVWUDFW DFWXDOLW\ RI WK  
 7KXV GHVLJQ PDLQO\ IRFXVHV RQ KRZ WR FRQGXFV WH  
 UHVXOW > @ ,Q D VHQVH WKH FRXUVHV RI GHVLJQ V  
 HGXFDWLRQ DV DQ HVVHQWLDQ SDUW RI LQWHULRU DU  
 LQ HGXFDWLRQ WKH 'HVLJQ 6WXGLR YDULHV LQ WHUPV  
 IRU LQGLYLGXDO ,QWHULRU \$UFKLWHFWXUH GHSDUWPH  
 DFDGHPLF PHPEHU LQ WKH SURMHFW FRXUVHV FRQGXFV  
 PHQWRU V\ VWHP KDV UHVXOWHG LQ IDLOXUH WR VXV  
 UHGXFHG WKH SURGXFWLYLW\ DQG TXDOLW\ RI HGXF  
 ,QWHULRU \$UFKLWHFWXUH GHSDUWPHQWV UHVXOWV LQ  
 \$FFRUGLQJO\ WKH VWXG\ DGGUHVHV ,QWHULRU \$UF  
 SURFHVV ,QWHULRU \$UFKLWHFWXUH GHSDUWPHQWV L  
 PHWKRGV RI GHVLJQ VWXGLR 7R WKLV DLP WKH SXUS  
 PHWKRGV DSSOLHG LQ YDULRXV IRUPV LQ WKH GHVLJQ  
 LQ 7XUNH\

'HVLJQ 6WXGLR (GXFDFWLRQ DQG 0HWKRGV DV  
 'HSDUWPHQWV

,QWHULRU \$UFKLWHFWXUH LV D ILHOG RI RFFXSDW  
 VFLHQWLILF WHFKQLFDO GDWD WR EH UHIOHFWHG LQ  
 WHFKQLFDO DHVWKHWLF VROXWLRQV WR HQVXUH XVHU  
 VW\OH DQG LGHQWLW\ IRU WKH VSDFH > @ (PHUJLQJ  
 LQWHULRU DUFKLWHFWXUH > @ HQWHUHG WKH SURFHVV  
 D SURIHVVLRQ QRW ORQJ DIWHU ZKHQ D KLJKHU HGXF  
 IRU WKH ILUVW WLPH E\ 3DUVRQ V 6FKRRO RI 'HVLJQ W  
 HGXFDFWLRQDO PHWKRGV YDU\ IRU ,QWHULRU \$UFKLWH  
 LQFUHDVHV UDSLGO\ WRGD\ 3UHVHQFH RI PDQ\ GHSDU  
 GLIIHUHQW DVSHFWV LQFOXGLQJ WKHRU\ DUW WHFKQ  
 WDNLQJ LQR FRQVLGHUDWLRQ WKH SURJUDP PHDVXUH  
 HGXFDFWLRQ 1HYHUWKHOHVV VLQFH GHSDUWPHQWV VH  
 VDPH EXW WKH\ DUH VKDSHG WKURXJK GLIIHUHQW PH  
 \$UFKLWHFWXUH GHSDUWPHQWV FRQVLGHU &,'\$ FULWH  
 VWUXFWXUH > @ &,'\$ LV DQ LQWHUQDFWLRQDO 1\*2  
 \$UFKLWHFWXUH HGXFDFWLRQ SURJUDPV LQ WKH 86 DQG  
 RI ,QWHULRU \$UFKLWHFWXUH HGXFDFWLRQ \$FFRUGLQJ  
 LPSURYH WKH TXDOLW\ RI LQWHULRU VSDFHV ZLWK W  
 HIILFLHQF\ DQG HQVXUH VHFUXLW\ RI SHRSOH RQ D SUR  
 H[SHULHQFHV 7KH GLIIHUHQFHV DPRQJ FXUULFXOD RI  
 7XUNH\ DUH PDLQO\ UHIOHFWHG RQ FRXUVH FRQWHQW  
 FXUULFXOXV LV WR WDUJHW WKH SURMHFW DQG DGDSW  
 LQ GHVLJQ DQG IRU VWXGHQWV ZLWK FRPELQHG XVH F  
 DGRSW D YHUEDO ODQJXDJH EHIRUH DWWHQGLQJ GHVL

ODQJXDJH ,Q RWKHU ZRUGV WKH\ DUH IDFHG ZLWK WK  
WKLQNLQJ DQG SUHVHQWDLRQ > @ %DVHG RQ VXFK L  
H[HFXWRU PXVW FRPSOHPHQW RQH DQRWKHU )RU -X  
DGGUHVVLQJ WKH UHODWLRQV DPRQJ H[HFXWRU VWXG  
EHWZHHQ WKH VWXGHQW DQG NQRZOHGJH VWXGHQW P  
WKH\ DOVR GHSHQG RQ WKH H[HFXWRU ([HFXWRU LQV  
H[HFXWRU %HLDUW EHOLHYHV LQ WKH ILUVW SODFH I  
GHIHQGV WKH YDOLGLW\ RI RWKHU PHWKRGV LQ WKH IR  
VRFLDO HQYLURQPHQWV GULYLQJ FUHDWLYLW\ EH\RQG  
GHVLJQ VWXGLR HQYLURQPHQW IDFLOLWDWHV JHQHUDV  
WKDQ DFWLQJ DV D SK\VLFDQ VSDFH ZKHUH WKH GHVLJ  
> @ 'HVLJQ VWXGLR LV D FUHDWLYH SURFHVV LQYRO  
H[HFXWRU ,W IHDWXUHV FRRSHUDWLYH ZRUN IURP WKH  
DQG g]NHU > @ OLVWV WKH JHQHUDO WHDFKLQJ PHWK  
IROORZV

- ‡ 3UREOHP VROYLQJ PHWKRG 'LVFXVVLRQ OHWKRG
- ‡ ,QGLYLGXDO :RUNLQJ OHWKRG ,QGLYLGXDO :RUNLQJ
- ‡ OHWKRGV RI ([SUHVVLRQ 6HPLQDU (QYLURQPHQW
- ‡ &DVH 6WXG\ OHWKRG /LEUDU\ (QYLURQPHQW
- ‡ ([HFXWLRQ ([SHULHQFH OHWKRG ORGHO %XLOGLQJ
- ‡ &RPSXWHU 8VDJH (QYLURQPHQW

([HFXWRU LQ WRGD\ V GHVLJQ VWXGLRV EHQHILW IU  
PHWKRGV LQVWHDG RI D VLQJOH HGXFDWLRQDO PHWK  
ZRUNVKRS SOD\ V D NH\ UROH LQ HIIHFWLYH LPSOHPH  
PHWKRGV RI GHVLJQ VWXGLRV ZKLFK YDU\ IRU LQGLYL  
XVXDOO\ DV IROORZV %HVLGHV GHVLJQ VWXGLHV FRQ  
GHVLJQHU WDONV GHVLJQ GHVLJQHU ZRUNVKRSV H[F  
VHPLQDU GD\ V IRU H[SHUWV RU FRPSDQ\ RZQHUV HWF  
DGGWLWRQ SURMHFWV SUHSDUHG GXULQJ WKH WHUP F  
WKH FULWLFV 2QH WR RQH GLVFXVVLRQ JURXS FULWL  
NH\ UROH LQ WKH GHVLJQ VWXGLR FRXUVH 7KH\ PXVW  
VWXG\ DQG KHOS WKHP WR LPSURYH WKHLU VNLOOV LQ  
6WXGHQWV PXVW FRQVLGHU WKH GHVLJQ VWXGLR VSD  
PDQQHU ZKLOH WKH SURMHFW H[HFXWRU HQFRXUDJH  
HQYLURQPHQW

'HVLJQ 6WXGLR (GXFDFWLRQ DW ,QWHULRU \$U

7KHUH DUH VXEVDQWLDO GLIIHUHQFHV DPRQJ ,QV  
7XUNH\ %H\RQG WKDW WKH PDLQ SUREOHP RI RXU H  
LQFUHDVH LQ WKH QXPEHU RI GHSDUWPHQWV ZKLFK D  
QXPEHU RI WUDLQHG DFDGHPLFLDQV LV ORZ ,Q 7XU  
\$UFKLWHFWXUH GHSDUWPHQWV DQG D QHZ RQH MRLQV  
LQ QXPEHU :KLOH WKH FRXUVHV DW GHSDUWPHQWV ZL  
WKH QXPEHU RI DFDGHPLF PHPEHUV IDOOV VKRUW RI  
FRXUVHV OD[LXP QXPEHU RI SURMHFW VWXGHQWV IRU  
SURGXFWLYH HGXFDWLRQ E\ WKH HQG RI WKH WHUP :K  
WZHOYH LW ZLOO QRW EH SRVVLEOH WR VSHDN RI TXI

FRXUVH KRXUV 7KH WLPH RI SURMHFW FRXUVHV PXVW  
VWXGHQW IDFLOLWDWLQJ VXIILFLHQW WLPH DQG VS  
\$UFKLWHFWXUH GHSDUWPHQWV LV IRXU \HDUV HLJKW  
GHOLYHU ILYH WHUP SURMHFWV DQG RQH JUDGXDWLR  
GHSDUWPHQWV SULRULWL]H WKH FRQFHSW RI GHVLJQ  
SUHFHGHQFH WR DSSOLHG WUDLQLQJ 7KHUHIRUH WKH  
WKH DJUHHG FXUULFXOD \$QG WKLV LV UHIOHFWHG R  
H[DPSON DQ ,QWHULRU \$UFKLWHFWXUH GHSDUWPHQW  
VWXGLR FRXUVHV ZKLOH DQRWKHU GHSDUWPHQW RI  
WUDQVIHUULQJ FRXUVHV IURP GHSDUWPHQWV ZLWK H[  
DQG KRXU RI RWKHU FRXUVHV DUH UHGXFHG 2Q WKH R  
OHVV KRXUV RI GHVLJQ VWXGLR FRXUVHV WKH KRXUV D  
QRW SRVVLEOH WR FUHDWH D SURGXFWLYH SURMHFW  
GHVLJQ VWXGLR &XUULFXOD VHUYH DV WKH PLUURU R  
ZLWK WKH SXUSRVHV RI HGXFDWLRQ ,QWHULRU \$UFKL  
HOHPHQWV ZLWKLQ IDFXOWLHV RI DUFKLWHFWXUH ZKL  
)RU H[DPSON WKH FRXUVH FRQWHQWV RI D GHSDUWP  
FRXUVHV OLNH YROXPH GHVLJQ IXUQLWXUH GHVLJQ ZK  
RQ PDLQO\ VWUXFWXUH FRXUVHV OLNH NQRZOHGJH RI  
KRZ FRXUVHV RI GLIIHUHQW TXDOLWLHV LQ WKH FXUU  
GLYHUW IURP RQH DQRWKHU > @ (VSHFLDOO\ WKH GHV  
GHVLJQ VWXGLR GLIIHU JUHDWO\ IRUP GHSDUWPHQW V  
GHWDLO RULHQWHG VROXWLRQV ZKLOH RWKHUV DFW  
LPSRUWDQW VWDJH RI GHVLJQ FRXUVHV LV GUDZLQJ V  
LQWHULRU DUFKLWHFWXUH DQG RWKHU YLVXDO DUWV L  
RI GHVLJQ HQVXUHV LQWHJUDWLRQ RI VWXGHQW V LP  
FRQLQXHV IURP WKH VWDUW WR WKH ODVW SKDVH RI  
DSSOLHG LQ WKH GHVLJQ VWXGLR LV SDUWLFXODUO\ UH  
7KH PRUH VXIILFLHQW LV WKH WLPH VSDUHG IRU SURM  
IRFXV RQ WKHLU SURMHFW 7KH GHVLJQ HGXFDWLRQ SU  
OLPLWHG H[SUHVVLRQ WHFKQLTXHV WKH HGXFDWLRQ  
ZLWK YDULRXV WKHRULHV DQG PHWKRGV LQFOXGHG LQ  
PRVW FRPPRQ WHFKQLTXHV LQ GHVLJQ VWXGLR HGXFD  
PHWDSKRU HYROXWLRQDU\ GHVLJQ VTXDUH \* PHWKR  
SUDFWLFHV > @ 6XFK YDULRXV VWXGLR SUDFWLFHV D  
GLVFXVV GHVLJQ DQG WR LPSURYH GHVLJQ H[SHULHQFH  
FRQVXLQJ FRXUVH LQ WKHLU HGXFDWLRQ DW WKH VFK  
RIILFH HQYLURQPHQW ZKHUH OHDUQLQJ LV FRPPXQLFD  
GHVLJQ VWXGLR FRXUVH PXVW EH XVHG RQO\ IRU WKH S  
EH DEOH WR ZRUN FRPIRUWDEO\ LQVLGH DQG RXWVLGH  
PRVW LPSRUWDQW DVSHFW RI GHVLJQ VWXGLRV PDNLQ  
UHIOHFW D GLIIHUHQW OLIHVW\OH > @ ,Q WKLV VHQV  
WDNHQ LQWR FRQVLGHUDWLRQ WR GHVLJQ VSDFHV D  
RSSRUWXQLW\ IRU SHUVRQDO H[SHULHQFH IURP WKH  
ZKHUH LQGLYLGXDOV FDQ EH IUHH LQ WKHLU FRQFHSW  
DQG VSDFH PXVW EH GHILQHG WR HVWDEOLVK ZRUNLQJ

7DEO HQWHULRU DUFKLWHFWXUH GHSDUWPHQWV QXPEHU RI V

,QWHULRU DUFKLWHFWXUH GHSDUWPHQWV SODFHF		3RI	4XRWD	/DQJXDJH	&RXUVH	+R
8QLYHUVLW\	)DFXOW\	'HSDUWPHQW	7\SH			
\$NGHQLJ 8QLYHUVLW\	)DFXOW\	QWHULRU \$U	0		'HVLJQ 6WXGLR	
\$QDGROX 8QLYHUVLW\	)DFXOW\	(QYLURQPHQWDO	0		'HVLJQ	
%DKoF	)DFXOW\ RI \$UF	,QWHULRU \$U	0		'HVLJQ	
8QLYHUVLW\ 'HVLJQ	)DFXOW\ RI LQH	(QYLURQPHQWDO	0		'HVLJQ	
dXNXI	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
8QLYHUVLW\	)DFXOW\ RI LQH	(QYLURQPHQWDO	0		'HVLJQ	
)DWLK	)DFXOW\ RI	(QJLQHULRU DQG	0		'HVLJQ	
0HKPHW 8DNDI	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
*HGLN 8QLYHUVLW\	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
*HGLJ 8QLYHUVLW\	)DFXOW\ RI	(QJLQHULRU DQG	0		'HVLJQ	
+DFH\	)DFXOW\ RI LQH	QWHULRU \$U	0		'HVLJQ	
8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
+DVDQ .D	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
,úõN 8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
øKVDQ 'R	)DFXOW\ RI LQH	QWHULRU \$U	0		'HVLJQ	
%LONHQW 8DNDI	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
øVWDQI	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
øVWDQEXO %DGL	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
øVWDQEXO	)DFXOW\ RI	(QJLQHULRU DQG	0		'HVLJQ	
.HPHUEXUJD	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
øVWDQEXO 7HFKQLFDO	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
øVWDQE)	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
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øJP (FRQ	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
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.DGLU	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
.DUDE	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
7HFKQLFDO	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
8QLYHUVLW\	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
.RFDHOL 8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
.72 .DUI	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
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6HOoXN 8QLYHUVLW\	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
6HOoXN 8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
72% 8QLYHUVLW\	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
RI (FRQRPLF)	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	
7HFKQRORJ\	)DFXOW\ RI	QWHULRU \$U	0		'HVLJQ	
<DúDU 8QLYHUVLW\	)DFXOW\ RI	(QYLURQPHQWDO	0		'HVLJQ	

7DEOH FR QWLHQXHU DUFKLWHFWXUH GHSDUWPHQW QXPEH  
 LQ 7XUNH\

,QWHULRU DUFKLWHFWXUH GHSDUWPHQW DGPLW\							
8QLYHUVLW\	)DFXOW\	'HSDUWPHQW	3RL 7\SH	4XRWD	/DQJXDJH	&RXUVH	+RX
\$W00OP 8Q	)DFXOW\ RI )LQH \$UWV	,QWHULRU DUFKLWHFWXUH	DQG (QYLURQP	6SHI	SELOLW\	7XUNLVK	,QGRRU 'HVLJQ
\$YUDV\ D 8Q	)DFXOW\ RI (QJLQH DUFKLWHFWXUH	,QWHULRU DUFKLWHFWXUH	DQG (QYLURQP	6SHI	SELOLW\	7XUI	,QWHULRU SUFKLWHFWXUH 3URMHFW
%DúNHQW 8Q	)DFXOW\ RI )LQH \$UWV	,QWHULRU DUFKLWHFWXUH	DQG (QYLURQP	6SHI	SELOLW\	7XUI	'HVLJQ 6WXGLR
%H\NHQW 8Q	)DFXOW\ RI (Q SUF	,QWHULRU SUF	DQG (QYLURQP	6SHI	SELOLW\	7XUI	'HVLJQ 6WXGLR
&DQLN	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	3URMHFW
8QLYHUVLW\ (QJLQH HULQJ	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	'HVLJQ 6WXGLR
dDQN	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	3URMHFW
8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	3URMHFW
'R=Xú 8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	3URMHFW
+DOLo 8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	3URMHFW
,úON 8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	3URMHFW
oVWDQE	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWI
8QLYHUVLW\ 'HVLJQ	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	SUFKLWHFWXUH 'HVLJQ
oVWDQEXO *HQLP	)DFXOW\ RI )LQH \$UWV	,QWHULRU	DQG (QYLURQP	6SHI	SELOLW\	7XUI	3URMHFW
8QLYHUVLW\	)DFXOW\ RI )LQH \$UWV	,QWHULRU	DQG (QYLURQP	6SHI	SELOLW\	7XUI	,QWHULRU SUFKLWHFWXUH 3URMHFW
oVWDQEXO *HQLP	)DFXOW\ RI )LQH \$UWV	,QWHULRU	DQG (QYLURQP	6SHI	SELOLW\	7XUI	,QWHULRU SUFKLWHFWXUH
8QLYHUVLW\	)DFXOW\ RI )LQH \$UWV	,QWHULRU	DQG (QYLURQP	6SHI	SELOLW\	7XUI	'HVLJQ 6WXGLR
oDOWHSH 8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	(QJOLVK 'HVLJQ 6WXGLR
oDOWHSH 8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWI
0DUP	)DFXOW\ RI )LQH \$UWV	,QWHULRU		6SHI	SELOLW\	7XUI	SUFKLWHFWXUH 'HVLJQ
8QLYHUVLW\	)DFXOW\ RI )LQH \$UWV	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU SUFKLWHFWXUH 3URMHFW
0LPDU	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	'HVLJQ 6WXGLR
8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWI
\$UWV	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	SUFKLWHFWXUH DQG (QYLURQP HQWDO 'HVLJQ
1LúD(	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	'HVLJQ 6WXGLR
8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWI
2NDQ 8QLYHUVLW\	)DFXOW\ RI )LQH \$UWV	,QWHULRU		6SHI	SELOLW\	7XUI	SUFKLWHFWXUH DQG (QYLURQP HQWDO 'HVLJQ
7RURV 8QLYHUVLW\	)DFXOW\ RI )LQH \$UWV	,QWHULRU		6SHI	SELOLW\	7XUI	'HVLJQ 6WXGLR B
<HGL	)DFXOW\ RI )LQH \$UWV	,QWHULRU		6SHI	SELOLW\	7XUI	3URMH
8QLYHUVLW\	)DFXOW\ RI )LQH \$UWV	,QWHULRU		6SHI	SELOLW\	7XUI	,QWI
<HQL\	)DFXOW\ RI (Q	,QWHULRU		6SHI	SELOLW\	7XUI	SUFKLWHFWXUH 3URMHFW
8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,CRRU 'H 6WXGLR
=LUYH 8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU SUFKLWHFWXUH 'HVLJQ
(DVV	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWI
0HGLWHUUD	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	SUFKLWHFWXUH :RUNVKRS
8QLYHUVLW\ .NWF	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
(DVV	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
0HGLWHUUD	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
8QLYHUVLW\ .NWF	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
*LUQH \$P	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
7XUNLVK 5HSXEOLF	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
2I 1RUWKHUQ	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
& \SUXV	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
(XUR	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
8QLYHUVLW\ 2I	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
/H\NH 7XUNLVK	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
5HSXEOLF 2I	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
1RUWKHUQ & \SUXV	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
& \S	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU 'HVLJQ 6WXGLR
,QWHUQDWLR	)DFXOW\ RI )LQH \$UWV	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU SUFKLWHFWXUH 3URMHFW
8QLYHUVLW\	)DFXOW\ RI )LQH \$UWV	,QWHULRU		6SHI	SELOLW\	7XUI	,QWHULRU SUFKLWHFWXUH 3URMHFW
1HDU	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	,QWI
8QLYHUVLW\	)DFXOW\ RI \$U	,QWHULRU		6SHI	SELOLW\	7XUI	SUFKLWHFWXUH 6WXGLR
6RXUFH 26<0	'HF						

### &RQFOXVLRQ

\$V RQH RI WRGD\ V SRSXODU SURIHVVLRQV ,QWHU  
 GHSDUWPHQWV HYHU\ GD\ 7KLV JURZWK LQ QXPEHU P.  
 ZLWKRXXW KLQGHULQJ WKH HGXFDWLRQDO OLIH 6XIILF  
 ZLWK PRUH VWXGHQWV DQG FRQWUROOHG QXPEHU R  
 FRQWULEXWH WR WKH LQVWLWXWLRQDOL]DWLRQ RI HO  
 LPSRUWDQW IRU GHVLJQ VWXGLRV DV WKH EXLOGLQJ VV  
 HGXFDWLRQ LV D FRQFHSW GHILQH ZLWK GLIIHUHQW  
 DSSURDFKLQJ GHVLJQ VWXGLRV DQ HIIHFWLYH FRXUVH  
 GLIIHUHQW HGXFDWLRQDO PHWKRGV 7KH FRQWHQW RI  
 LQVWLWXWLRQV VWXGHQW VHOHFWLRQ PHWKRGV DQG  
 DQG HGXFDWLRQ PRGHV PXVW EH GHYHORSHG PHW  
 SHUVSHFWLYHV PXVW EH UH DQDO\VHG DQG IRUPDWWH  
 SURIHVVLRQ > @ &RQVLGHULQJ GHVLJQ VWXGLRV DV  
 PHWKRGV VXSSRUWLQJ GHVLJQ DQG GHVLJQ SURFHVV E  
 HGXFDWLRQ V\ VWHP IRFXVLQJ RQ DGGUHVVLQJ WKH GH  
 GHVLJQ VWXGLRV WR WDNH VKDSH WKH VWXGHQW PX  
 LQVWLOO UHVSQRVLELQJ\ DQG VHOI FRQILGHQFH LQ  
 LPSRUWDQW IDFWRU LQ GHVLJQ VWXGLRV ZLWK WKH H  
 H[SHFWHG WR WKLQN LQ D VRSKLVWLFDFWHG PDQQHU  
 V\QWKHVHV DQG WR PDNH DVVHVVPHQWV DV RSHQ PLQ  
 WKLV VHQVH IDYRUDEOH FRQGLWLRQV PXVW EH HQVX  
 GHVLJQ SURFHVV \$FFRUGLQJO\ WKH VWXG\ PDNHV WK  
 JDLQ H[SHULHQFH XQGHU VXSHUYLVLRQ RI DFDGHPLFLD  
 WR DFDGHPLF PHPEHUV LQ GHVLJQ VWXGLR FRXUVHV  
 GHVLJQ DQG SUDFWLFH &UHDWH VSDFHV IDFLOLWDWL  
 ,QFUHDVH GHVLJQ VWXGLR FRXUVH KRUV DQG UHGXFH  
 ZLWKLQ WKH GHSDUWPHQW \$QG ILQDOO\ WKH GHVLJQ  
 DQG VXSSRUWLQJ DFWLYLWLHV PXVW EH FRQGXFWHG  
 REVHUYDWLRQ ILHOG VWXGLHV DQG RWKHU ZRUNVKRS  
 ZLWK SURVSHFWLYH ,QWHULRU \$UFKLWHFWV ZKR DUH F  
 DELOLW\ RI FULWLFDO WKLQNLQJ 7KH GHVLJQ VWXGLR  
 LQFOXGHG LQ WKH FXUULFXOD RI HVSHFLDOO\ VHQLRU  
 SUDFWLFH \$FFRUGLQJO\ WKH VWXG\ HPSKDV]HV WKD  
 LQWHULRU DUFKLWHFWXUH HGXFDWLRQ KLJKOLJKWLQJ

### 5HIHUUHQFHV

\$GÕJ]HO ' 7•UNL\H†GHNL Lø PLPDUOÑN H÷LWLPLQG  
 .DGLU +DV 8QLYHUVLW\ ,VWDQEXO SDJH  
 %LHOHIHOG % .KRXOL 6 ( \$GÕP \$GÕP 7DVDUÕP )  
 &RUGDQ g \*|UJ•O ( dLQoLN % 1XPDQ % øo  
 <DNDODPDN ø7h gUQH÷L ød0(.,QWHULRU \$UFKLWH  
 &RQJUHVV ,VWDQEXO 7XUNH\ 'HF S > @0  
 0F&HOODQG 3URIHVVLRQDOL]LQJ ,QWHULRU 'HFRUDV

-RXUQDO RI 'HVLJQ +LVWRU\ > @0DVVH\  
7KDPHV DQG +XGVRQ 3XEOLFDWLRQV  
'HPLUEDú 2 g 'HVLJQ 6WXGLR DV D OLIH VSDFH  
6FLHQFHV 0DVWHU V 7KHVLV \$QNDUD S  
(UW•UN = 0DQDY % øN• øo 0LPDUOÖN gUQH÷L h]H  
ød0(. ,QWHULRU \$UFKLWHFWXUH (GXFDWLRQ QG 1DW  
S .D\QDN ,,'\$ ,QWHUQDWLRQDO ,QWH  
ZZZ LLGD RUJ ZKDW LV LQWHULRU GHVLJQ  
øQFHR÷OX 1 \*•UHU 7 dLO ( '•ú•QPH YH DQODW  
3XEOLVKLQJ øVWDQEXO VD\ID  
.DSWDQ % 7•UNL\H\GH øo PLPDUOÖN H÷LWLPLQ JH  
VRUXQ VW 1DWLRQDO ,QWHULRU \$UFKLWHFWXUH  
06\*68 \$UFKLWHFWXUH )DFXOW\ 3XEOLVKLQJ 1R 2F  
.HWL]PHQ \* d 0LPDUL 7DVDUÖP 6W•G\RVXQXQ %L  
0HNDQVDO (WNLOHULQ øQFHQPHVL \$QDGROX 8QL  
7KHVLV \$XJXVW S  
g]NHU 6 ,Q WKH FRQWH[W RI LQWHULRU DUFKLWH  
0RGHOV \*HUPDQ 7XUNLVK <HDU RI 6FLHQFH +DFHW  
,QWHUQDWLRQDO ,QWHULRU \$UFKLWHFWXUH (GXFDW  
PHPR ERRNOHW 'HFHPEHU  
g]W•UN g % \*•Q•P•] 7DVDUÖP (÷LWLPLQGH <|QWHP  
h]HULQH %LU 'HQPH ,QWHUQDWLRQDO &RQIHUHQFH  
,PSOLFDWLRQV 1RYHPEHU \$QWDO\D 7XUNH\  
7X÷OX .DUVOÖ 8 g]NHU 6 <sup>3</sup>\*•Q•P•] 7DVDUÖP 6W•G  
<|QWHPOHUL YH \$W|O\HQLQ 0HNDQVDO .XUJXVXQD  
\$UFKLWHFWXUH 'HVLJQ &XOWXUH DQG \$UW 0DJD]LQ  
<ÖOGÖUÖP 6 \*•YHQø . 0LPDUOÖN (÷LWLPLQGH 7DV  
)RUXP 1DVÖO %LU \*HOHFHN" 0HPRV ,78 ,VWDQEXO  
=RUOX 7 \$NJ•O % (UED\ 0 2QXU ' \$UDV \$  
WDVDUÖP VW•G\RODUÖQD IDUNOÖ ELU EDNÖú UHVL  
\$UFKLWHFWXUH (GXFDWLRQ QG 1DWLRQDO &RQJUHVV

85/ 7KH FRXQFLO IRU LQWHULRU GHVLJQ DFFUHGL  
KWWS DFFUHGLW LG RUJ SURIHVVLRQDO VWDQGDUG